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FOR WAR.

DETERMINATION
OF THE POSITIONS OF
FEAGHMAIN AND HAVERFORDWEST,
LONGITUDE STATIONS ON THE GREAT EUROPEAN ARC OF PARALLEL.

BEING AN APPENDIX TO THE ACCOUNT OF THE PRINCIPAL TRIANGULATION
OF
GREAT BRITAIN AND IRELAND.

BY
CAPTAIN A. R. CLARKE, R.E., F.R.S.,

UNDER THE DIRECTION OF

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COR. MEM. OF THE ROYAL GEOGRAPHICAL SOCIETY OF BERLIN,
DIRECTOR OF THE ORDNANCE SURVEY.

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1867.

DETERMINATION

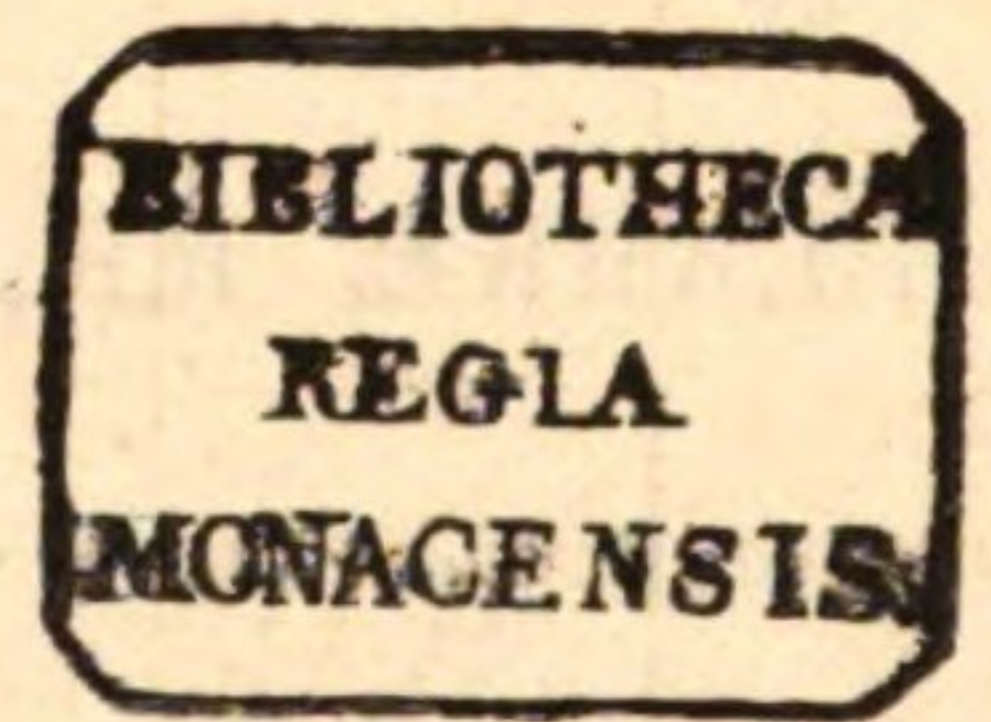
OF THE POSITION OF

FEAGHMAH AND JAFFERBORD WEST

IN THE STAFFS OF THE GREAT BRITAIN

AND AS A RESULT OF THE SURVEY OF THE DISTRICT

OF THE DISTRICT OF JAFFERBORD



COMMISSIONER OF THE DISTRICT OF JAFFERBORD

AND AS A RESULT OF THE SURVEY OF THE DISTRICT

IN THE STAFFS OF THE GREAT BRITAIN



PRINTED BY GEORGE BROWN & SONS, LONDON

AND AS A RESULT OF THE SURVEY OF THE DISTRICT

OF THE DISTRICT OF JAFFERBORD

1867

VALENTIA.

1.

The Great European Arc of Parallel in Latitude 52° , has its western termination in the Island of Valentia in the south-west of Ireland. A map of the island and the neighbouring coast on the scale of one inch to the mile will be found in Plate I., and in Plate II. a plan of contour lines showing the features of the ground and enabling us to compute the attraction due to irregularities of the surface. Plate III. shows the connection of the three stations in the island with the principal Triangulation of Ireland.

The station Feaghmain, otherwise called Geokaun, is the highest point in the island. The height of the top of Feaghmain is marked on the map 888 feet above the mean level of the sea; the station is indicated by a small Δ . From this point the ground falls in every direction; and about a quarter of a mile to the west there is a precipice of about 600 feet down to the sea, called the Fogher Cliff. About half a mile to the north-east are the extensive slate quarries of Valentia. The Longitude of this point was determined in the summer of 1844 by the Astronomer Royal (assisted by Captain Gosset, R.E., and a party of Sappers from the Ordnance Survey) by transmission of chronometers. The recent connection of the Island of Valentia by magnetic telegraph with England rendered it not only possible but very desirable to repeat the Longitude determination by the method of galvanic signals; accordingly, in the summer of 1862, the necessary arrangements were made for so determining the Longitude of a point in the village of Knightstown not far from the Telegraph Office. It became then necessary to connect the station in Knightstown with the principal Triangulation of Ireland; accordingly, a party of men from the Ordnance Survey were sent at the same time to effect this junction in a scrupulously accurate manner.

On referring to the "*Account of the Principal Triangulation*," pp. 110, 126, 403, 404, and Plate xvi., Fig. 29, it will be seen that Feaghmain is connected with the Principal Triangulation stations, Hungry Hill and Baurtregaum, by two intermediate stations—Knocknadober and Knocknagante. The angles at these two stations, as well as at Feaghmain, were not satisfactory, having been observed with small instruments, and the corrections to the angles as given at page 404 are consequently large. The probable errors attached to these observed angles are not however sufficient to throw any doubt on the fixation of the station Feaghmain; but they throw doubt upon the direction of the Meridian at that station.

The position of Feaghmain as the terminus of an Arc of Parallel is open to some objection, which appears on looking at the map, in the sudden fall of the ground by a precipice to the west and north-west, indicating the probable existence of an easterly deviation of the plumb-line, which, if it really exists, would make the observed Longitude too large. At Knightstown, on the contrary, we should expect to have a westerly attraction and the observed Longitude too small.

The observation of the direction of the Meridian at the terminal stations of an Arc of Parallel is of the greatest importance—they are an immediate check upon the observed Longitudes, and would be similarly affected, though not to the same amount, by any local attraction not in the direction of the Meridian. It was therefore necessary to determine very carefully the direction of the Meridian at one or other of the two longitude stations—Feaghmain or Knightstown, or at some intermediate station. By taking an intermediate and independent station a further insight is obtained into the question of local attraction. The point fixed upon, called Kilbeg Station, is on a hill rather more than a mile west-south-west of Knightstown and 570 feet high. The wooden transit house was erected on the hill and a pier built of brickwork for the transit instrument and a second pier for the clock. Two Meridian marks were erected; the North Meridian mark was about a mile and

a quarter distant in the western extremity of the Island of Beginish: it was a slab of slate accurately cut in the form of the gable end of a house, and was secured by cutting a bed for its lower edge in the rock and running in with lead. A vertical slit was cut through the slate for a lamp to shine through by night, and a small circle painted white, for day work, two inches in diameter. The South Meridian mark is nearly four miles south of the station, and on the eastern extremity of a flat-topped hill in the farm of Gurrana: it is 13.5 feet S.S.W. of an old trigonometrical station marked on the map—height 1310 feet. The Meridian mark was simply a well-cut pole erected in an accurately vertical position, surrounded with a pile of turf. The old centre stones at the stations Knocknagante and Knocknadober were found undisturbed.

The theodolite station at Kilbeg Hill was not identical with the transit station, but was 12.56 feet due *south* of it. The station is marked by a hole drilled $\frac{3}{8}$ inch in diameter in a stone sunk about one foot below the general surface of the ground. The 18-inch theodolite was set up at the station on 12th August 1862, and accurately adjusted into the Meridian of the transit instrument by causing the cross wires of the theodolite and the centre wire of the transit to intersect reciprocally. The point fixed in the Triangulation is this and not the transit station.

The transit observations for direction of the Meridian were made by Serjeant-Major, now Quartermaster, James Steel, R.E. The observations with the 18-inch theodolite by Corporal Compton, R.E.

Plate III. shows the Triangulation. The station at Knightstown was observed from Feaghmain, Kilbeg, and the South Meridian mark, but it was not considered necessary to take angles at it.

2.

In the following pages will be found the observations with the 18-inch theodolite. The method of reducing is explained both in the "*Account of the Principal Triangulation*," and in the account of the "*Extension of the Triangulation into France and Belgium*." It will suffice to remark here that those observations to which the observer has appended a remark, indicating a not very satisfactory bisection of the object from whatever cause, are considered as having half weight, and are characterized in the tables following by the fraction $\frac{1}{2}$ following the decimals of seconds.

FEAGHMAIN.

Arc.	Date.	Time.	Gurrana, R.O.	Brandon.	Baurtre- gaum.	Knock- nadober.	Knights- town.	Knock- nagante.	Kilbeg Hill.	<i>x.</i>
			338° 49'.	190° 14'.	228° 2'.	236° 16'.	266° 24'.	276° 21'.	276° 56'.	
	1862.	H. M.	"	"	"	"	"	"	"	"
1	July 25	5 15 P.M.	40.13			51.68				+ 0.13
2	" 26	10 35 A.M.	39.59			52.20				- 0.41
3	" "	11 0 "	39.17			52.17		28.92 $\frac{1}{2}$		- 0.83
4	" "	11 25 "	38.50			52.68		29.50		- 1.50
5	" "	11 50 "	40.90			51.10 $\frac{1}{2}$		29.57 $\frac{1}{2}$		± 0.90
6	" "	12 30 P.M.	41.05		22.44 $\frac{1}{2}$				15.91	+ 1.05
7	" "	12 55 "	40.26			50.77		29.66		+ 0.26
8	" "	1 25 "	41.00			49.96			17.76	+ 1.00
9	" "	1 55 "	40.19						16.72	+ 0.19
10	" "	4 10 "	38.94			50.85			18.93	- 1.06
11	" "	4 50 "	37.78			53.68 $\frac{1}{2}$			16.15	- 2.22
12	" "	5 20 "	40.30				32.80		15.86	+ 0.30

FEAGHMAIN—continued.

Arc.	Date.	Time.	Gurrana, R.O. 338° 49'.	Brandon. 190° 14'.	Baurtre- gaum. 228° 2'.	Knock- nadober. 236° 16'.	Knights- town. 266° 24'.	Knock- nagante. 276° 21'.	Kilbeg Hill. 276° 56'.	x.
	1862.	H. M.	"	"	"	"	"	"	"	"
13	July 26	5 55 P.M.	40.62				31.94		16.39	+ 0.62
14	" "	6 10 "	39.33			52.13½				- 0.67
15	" "	6 20 "	40.09				31.26		17.60	+ 0.09
16	" 28	9 20 A.M.	39.64			51.50		29.53		- 0.36
17	" "	" "	40.05			51.75				+ 0.05
18	" "	10 30 "	39.75	19.54½				28.71		- 0.25
19	" "	10 50 "	39.27			54.33		27.08		- 0.73
20	" "	11 10 "	40.53			53.47		26.69		+ 0.53
21	" "	11 30 "	42.62				29.43			+ 2.62
22	" "	Noon	40.99	20.68½				26.95		+ 0.99
23	" "	1 5 P.M.	41.80			50.84		28.04		+ 1.80
24	" "	1 20 "	42.63			50.94½		28.42		+ 2.63
25	" "	1 35 "	40.75	21.70½			29.20			+ 0.75
26	" "	2 15 "	45.24		19.15½	51.80				+ 5.24
27	" "	2 28 "	41.78					26.14	17.86	+ 1.78
28	" "	2 50 "	40.39		17.53½		36.08			+ 0.39
29	" "	3 8 "	39.46			50.65		30.58		- 0.54
30	" "	3 50 "	41.76			53.10		25.82		+ 1.76
31	" "	4 10 "	40.55			50.77		29.36		+ 0.55
32	" "	5 30 "	39.50					29.00	17.30	- 0.50
33	" "	5 50 "	40.31					27.87	17.60	+ 0.31
34	" 29	9 10 A.M.	38.58			49.07	36.19			- 1.42
35	" "	" "	41.37			52.02		27.28		+ 1.37
36	" "	10 5 "	39.61				31.73		17.61	- 0.39
37	" "	10 45 "	37.84					30.47	17.48	- 2.16
38	" "	2 0 P.M.	40.02				32.69	28.21		+ 0.02
39	" "	4 45 "	39.21						17.69	- 0.79
40	" "	5 0 "	39.99					28.89		- 0.01
41	" "	5 25 "	39.28						17.62	- 0.72
42	" "	5 47 "	38.06					30.82		- 1.94
43	" "	6 5 "	39.43					29.45		- 0.57
44	" "	8 0 "	40.21	19.05						+ 0.21
45	" "	8 10 "	39.02	20.23						- 0.98
46	" "	8 25 "	42.28	16.97						+ 2.28
47	Aug. 1	10 25 A.M.	40.22						16.69	+ 0.22
48	" "	Noon	41.75						17.17	+ 1.75
49	" "	12 35 P.M.	39.70						17.20	- 0.30
50	" 2	11 15 A.M.	40.24			51.57				+ 0.24
51	" "	1 0 P.M.	39.94			52.09		28.66		0.06
52	" "	3 15 "	39.87			51.93				- 0.13
53	" "	5 0 "	39.12					29.82	16.84	- 0.88
54	" "	5 20 "	39.05			52.75				- 0.95
55	" "	5 55 "	39.21					28.68	17.90	- 0.79
56	" "	6 25 "	40.19			51.47		29.03		+ 0.19
57	" "	6 40 "	39.28		22.48					- 0.72
58	" "	7 0 "	36.71					32.17		- 3.29
59	" 4	3 15 "	39.88			53.31			15.51	- 0.12
60	" "	" "	39.89		21.87					- 0.11
61	" "	4 50 "	38.69					31.17	15.94	- 1.31
62	" 5	11 0 A.M.	40.49					28.39	16.92	+ 0.49
63	" "	2 30 P.M.	39.14					28.82	17.82	- 0.86
64	" "	4 55 "	40.27						16.64	+ 0.27
65	" "	5 20 "	39.35			54.44		26.89		- 0.65
66	" 8	2 50 "	39.90						17.01	- 0.10

FEAGHMAIN—continued.

Arc.	Date.	Time.	Gurrana, R.O. 338° 49'.	Brandon. 190° 14'.	Baurtre- gaum. 228° 2'.	Knock- nadober. 236° 16'.	Knights- town. 266° 24'.	Knock- nagante. 276° 21'.	Kilbeg Hill. 276° 56'.	x.
	1862.	H. M.	"	"	"	"	"	"	"	"
67	Aug. 8	3 25 P.M.	41.09						15.83	+ 1.09
68	" "	4 0 "	40.36						16.55	+ 0.36
69	" "	5 45 "	40.41						16.50	+ 0.41
70	" "	6 15 "	40.27						16.64	+ 0.27
71	" 9	10 0 A.M.	39.10			52.74		28.85		- 0.90
72	" "	10 30 "	40.16			52.80		27.23		+ 0.66
73	" "	10 55 "	40.24	19.02						+ 0.24
74	" "	11 20 "	39.93	20.02	21.06					- 0.07
75	" "	11 40 "	39.66	19.67	21.69					- 0.34
76	" "	Noon	39.31	19.66½	21.71					- 0.69
77	" "	12 20 P.M.	40.27		22.25	51.04				+ 0.27
78	" "	12 45 "	38.73		23.03					- 1.27
79	" "	1 3 "	39.09		23.43			28.13		- 0.91
80	" "	1 15 "	41.15		22.25			27.25		+ 1.15
81	" "	1 50 "	39.70		21.33	52.55				- 0.30
82	" "	2 35 "	38.54					30.57	16.67	- 1.46
83	" "	3 0 "	39.50					29.64	16.66	- 0.50
84	" "	4 0 "	40.86						16.05	+ 0.86
85	" "	4 40 "	40.50						16.42	+ 0.50
86	" "	5 0 "	41.50						15.42	+ 1.50
Means			40.04	19.47	21.80	51.94	32.37	28.73	16.88	
No. of Observations			86	10	13	33	9	38	35	
Reciprocal of Weight			0.033	0.287	0.185	0.088	1.214	0.109	0.035	

KILBEG HILL.

Arc.	Date.	Feaghmain, R.O. 96° 57'.	North Mark. 180° 0'.	Knocknadober. 229° 21'.	Knightstown. 251° 48'.	South Mark. 359° 59'.	x.
	1862.	"	"	"	"	"	"
1	August 15	62.36	13.35		2.83		+ 2.36
2	" "	59.73	13.36		5.46		- 0.27
3	" "	59.78	14.85		3.90		- 0.22
4	" "	58.99	13.40		6.14		- 1.01
5	" "	59.88	12.06		6.59		- 0.12
6	" "	59.15	13.12		6.28		- 0.85
7	" "	59.91	13.77			9.12	- 0.09
8	" "	61.54	13.98			8.05½	+ 1.54
9	" "	59.79	13.37				- 0.21
10	" "	59.77	12.73		6.03		- 0.23
11	" "	59.78	13.39				- 0.22
12	" "	60.32	13.05			9.42	+ 0.32
13	" "	59.32	13.05			10.44	- 0.68
14	" "	60.17	12.77			9.87	+ 0.17
15	" "	60.62	13.16			9.01	+ 0.62
16	" "	60.50				9.14	+ 0.50
17	" "	59.12	14.04				- 0.88

KILBEG HILL—continued.

Arc.	Date.	Feaghmain, R.O. 96° 57'.	North Mark. 180° 0'.	Knocknadober. 229° 21'.	Knightstown. 251° 48'.	South Mark. 359° 59'.	x.
	1862.	"	"	"	"	"	"
18	August 15	60.35	12.83				+0.35
19	" "	59.85	13.32				-0.15
20	" 16	59.24				10.39	-0.76
21	" "	59.95				9.67	-0.05
22	" "	58.44				11.19	-1.56
23	" "	60.68	12.45			9.68	+0.68
24	" "	59.84	13.95			9.02	-0.16
25	" "	59.19	13.26			10.36	-0.81
26	" "	59.01		44.99		11.24	-0.99
27	" "	58.55		46.41		10.26	-1.45
28	" "	60.29		45.31			+0.29
29	" "	58.91		47.09½		8.68	-1.09
30	" "	60.82	13.20			8.78	+0.82
31	" "	60.05	12.62			10.13	+0.05
32	" "	59.97	13.78			9.04	-0.03
33	" "	60.49	13.21			9.10	+0.49
34	" "	60.84	12.65			9.30	+0.84
35	" "	59.15	14.33			9.33	-0.85
36	" "	60.33	13.55			8.93	+0.33
37	" 17	59.39		46.21			-0.61
38	" "	59.16		46.43			-0.84
39	" "	59.37		46.22			-0.63
40	" "	59.67	13.52			9.62	-0.33
41	" 18	60.22	13.64			8.93	+0.22
42	" "	60.49	12.89			9.43	+0.49
43	" "	59.93	13.23				-0.07
44	" "	60.36	12.81				+0.36
45	" "	60.54	12.63				+0.54
46	" 19	60.05				9.58	+0.05
47	" "	60.39				9.24	+0.39
48	" "	59.49				10.14	-0.51
49	" "	60.15	12.89			9.75	+0.15
50	" "	60.17				9.47	+0.17
51	" "	59.94				9.69	-0.06
52	" "	59.86		45.73			-0.14
53	" 20	60.12		45.49			+0.12
54	" "	59.76		45.83			-0.24
55	" "	60.51		45.09			+0.51
56	" "	59.78		45.82			-0.22
57	" "	60.34		45.26			+0.34
58	" "	60.21	13.81	44.74			+0.21
59	" "	59.66	12.97	46.13			-0.34
60	" "	60.27		46.10		8.86	+0.27
61	" "	60.39	13.05	45.34			+0.39
62	" "	61.34		44.27			+1.34
63	" "	60.63		44.98			+0.63
64	" "	61.09		44.52			+1.09
Means		60.00	13.26	45.56	5.32	9.56	
No. of Observations		64	38	20	7	33	
Reciprocal of Weight		0.015	0.016	0.043	0.488	0.026	

GURRANA HILL or SOUTH MARK.

Arc.	Date.	Feaghmain, R.O. 158° 50'.	Kilbeg Hill. 179° 58'.	Knightstown. 194° 23'.	Knocknadober. 214° 27'.	Knocknagante. 263° 52'.	x.
	1862.	"	"	"	"	"	"
1	August 25	60.58		43.15	20.35		+0.58
2	" "	59.20	47.54	44.73			-0.80
3	" "	59.44		45.30	19.34		-0.56
4	" "	58.59	47.79		20.37		-1.41
5	" "	59.87		42.41	21.79		-0.13
6	" "	59.67	47.32	44.47			-0.33
7	" "	59.87	46.08	45.52			-0.13
8	" "	61.38	46.31	43.79			+1.38
9	" 27	59.82	46.09	45.55			-0.18
10	" "	59.29	47.79				-0.71
11	" "	59.18	46.88			39.63	-0.82
12	" "	60.15	46.16			39.38	+0.15
13	" "	59.43	46.38			39.87	-0.57
14	" "	60.96	46.22			38.50	+0.96
15	" "	59.85	48.45			37.40	-0.15
16	" "	60.04	47.44			38.20	+0.04
17	" "	59.53	47.20			38.96	-0.47
18	" "	61.08	46.66			37.94	+1.08
19	" "	58.94	47.32			39.44	-1.06
20	" "	58.73	47.56			39.41	-1.27
21	" "	59.90	45.78			40.02	-0.10
22	" "	59.07	46.70			39.92	-0.93
23	" "	58.91	48.16				-1.09
24	" "	60.20	46.89				+0.20
25	" 28	60.70			18.98		+0.70
26	" "	60.22			19.46		+0.22
27	" "	59.14			20.54		-0.86
28	" "	60.89			18.79		+0.89
29	" "	59.92			19.75		-0.08
30	" "	59.99			19.68		-0.01
31	" "	59.92			20.48	37.90	-0.08
32	" "	61.15			19.53	37.60	+1.15
33	" "	60.84			19.91	37.53	+0.84
34	" "	60.78			19.17	38.33	+0.78
35	" "	60.06			19.02	39.20	+0.06
36	" "	60.79			19.91	37.58	+0.79
37	" "	60.40			20.79	37.11	+0.40
38	" "	60.89	46.32		19.56		+0.89
39	" "	59.14			20.17	38.98	-0.86
40	" "	61.29			19.29	37.71	+1.29
41	" "	59.87	45.95		20.94		-0.13
42	" "	60.08	45.55			40.05	+0.08
Means -		59.99	46.86	44.37	19.90	38.67	
No. of Observations -		42	24	8	21	22	
Reciprocal of Weight -		0.026	0.050	0.293	0.051	0.082	

KNOCKNADOBER.

Arc.	Date.	R. O. 237° 8'.	Gurrana Hill or S. Mark. 34° 34'.	Kilbeg Hill. 49° 28'.	Feaghmain. 56° 25'.	Brandon Hill. 168° 38'.	Bautre- gaum. 224° 43'.	Knock- nagante. 303° 48'.	Hungry Hill. 322° 6'.	x.
	1862.	"	"	"	"	"	"	"	"	"
1	Sept. 3	59.93	31.71					41.01		-0.07
2	" "	60.61		34.02	21.90					+0.61
3	" "	60.32	31.51					40.82		+0.32
4	" "	59.27	30.72					42.64		-0.73
5	" "	62.23			21.47					+2.23
6	" "	59.41	31.83							-0.59
7	" 4	60.81		33.94					15.36	+0.81
8	" "	61.85					18.71		17.77	+1.85
9	" "	59.16				39.31	18.74			-0.84
10	" "	58.20		33.08	25.25					-1.80
11	" "	60.40	30.95					41.29		+0.40
12	" "	59.46	32.59					40.60		-0.54
13	" "	58.47		32.53	25.52					-1.53
14	" "	61.77	29.44					41.44		+1.77
15	" "	58.83		32.46	25.23					-1.17
16	" "	59.63						41.63	17.42	-0.37
17	" "	59.89	29.63	34.56						-0.11
18	" "	60.61			23.09					+0.61
19	" "	60.63	30.68	32.77						+0.63
20	" "	61.20	30.29		23.45					+1.20
21	" "	60.72	29.86					42.07		+0.72
22	" 5	58.80		33.09	24.64					-1.20
23	" "	59.77	31.56	32.76						-0.23
24	" "	60.94				35.23				+0.94
25	" "	58.57			26.01	35.28				-1.43
26	" "	60.75				35.43				+0.75
27	" "	59.80				36.37				-0.20
28	" "	58.81	32.68						17.02	-1.19
29	" "	59.38	31.19	33.50						-0.62
30	" "	60.41			23.55			41.14		+0.41
31	" "	60.77				35.41				+0.77
32	" "	58.81						42.58		-1.19
33	" 9	61.65		31.50	23.39					+1.65
34	" "	59.64		29.87			24.36			-0.36
35	" "	59.86			20.53		24.34			-0.14
36	" "	58.13					24.04	40.27		-1.87
37	" "	60.39			20.20		24.13			+0.39
38	" "	58.62					22.64	41.18		-1.38
39	" "	58.73			24.40		21.60			-1.27
40	" "	61.01					20.43	41.01		+1.01
41	" "	59.01	33.07				20.19			-0.99
42	" "	60.60					19.89		17.84	+0.60
43	" "	60.70					19.94	41.79		+0.70
44	" "	59.24					22.06		17.01	-0.76
45	" "	59.88					21.31		17.13	-0.12
46	" "	60.87					20.17			+0.87
47	" "	59.81							17.47	-0.19
48	" "	59.42					22.17		16.72	-0.58
49	" "	61.41					21.18		15.72	+1.41
50	" "	61.70					21.14		15.47	+1.70
51	" "	59.74					21.29			-0.26
52	" "	60.87	29.52					42.24		+0.87
53	" "	61.22			23.04				16.70	+1.22
54	" "	61.41					20.09		16.82	+1.41

KNOCKNADOBER—continued.

Arc.	Date.	R. O. 237° 8'.	Gurrana Hill or S. Mark. 34° 34'.	Kilbeg Hill. 49° 28'.	Feaghmain. 56° 25'.	Brandon Hill. 168° 38'.	Baultre- gaum. 224° 43'.	Knock- nagante. 303° 48'.	Hungry Hill. 322° 6'.	x.
	1862.	"	"	"	"	"	"	"	"	"
55	Sept. 9	57.70	30.70						20.12	-2.30
56	" "	57.85			24.56				18.56	-2.15
57	" "	60.87						39.46	18.35	+0.87
58	" "	58.80	31.87						17.84	-1.20
59	" "	59.85			25.27				15.85	-0.15
60	" 10	60.06		35.75			18.06			+0.06
61	" "	61.06		32.74	22.72					+1.06
62	" "	60.11	32.69	31.28						+0.11
63	" "	60.47		31.50	24.57					+0.47
64	" "	60.77		31.78	23.97					+0.77
65	" "	61.33					19.09	42.03		+1.33
66	" "	60.45		31.13	24.96					+0.45
67	" "	59.57	32.22					40.84		-0.43
68	" "	59.10		33.73						-0.90
69	" "	59.33		33.50						-0.67
70	" "	60.58	28.86					43.20		+0.58
71	" "	59.10						42.64	16.94	-0.90
72	" "	59.28					20.31		18.73	-0.72
73	" "	59.73							17.55	-0.27
74	" "	60.61						41.73	16.33	+0.61
75	" "	59.86		32.10					18.16	-0.14
Means		60.01	31.12	32.74	23.70	36.17	21.13	41.51	17.26	
No. of Obser- vations - }		75	21	21	21	6	23	21	23	
Reciprocal of Weight - }		0.027	0.133	0.160	0.240	0.706	0.283	0.073	0.107	

KNOCKNAGANTE.

Arc.	Date.	Knock- moyle Hill, R. O. 170° 26'.	Gurrana Hill or S. Mark. 84° 10'.	Feaghmain. 96° 41'.	Knock- nadober. 123° 59'.	Baultre- gaum. 191° 45'.	Hungry Hill. 336° 41'.	x.
	1862.	"	"	"	"	"	"	"
1	September 16	59.79			48.92	56.96		-0.21
2	" "	61.25			47.78	56.63		+1.25
3	" "	59.61	54.97				13.13	-0.39
4	" "	61.07			46.94		11.48	+1.07
5	" "	61.39	55.08				11.26	+1.39
6	" "	61.68		6.40	46.27			+1.68
7	" "	60.95			47.59		10.94	+0.95
8	" "	60.53			49.94		9.02	+0.53
9	" "	58.99			48.53	58.15		-1.01
10	" "	59.44			47.32		12.71	-0.56
11	" "	56.90	58.20	7.49				-3.10
12	" "	60.20	54.97		48.38			+0.20
13	" "	57.96		7.48	48.92			-2.04
14	" "	63.12	52.22	7.26				+3.12
15	" "	59.68	57.17		46.69			-0.32
16	" "	60.83		6.75	46.77			+0.83

KNOCKNAGANTE—continued.

Arc.	Date.	Knock- moyle Hill, R. O. 170° 26'.	Gurrana Hill or S. Mark. 84° 10'.	Feaghmain. 96° 41'.	Knock- nadober. 123° 59'.	Bautre- gaum. 191° 45'.	Hungry Hill. 336° 41'.	<i>z.</i>
	1862 :	"	"	"	"	"	"	"
17	September 17	59.82				57.22	12.81	-0.18
18	" "	60.61	54.68			58.61		+0.61
19	" "	60.48		5.33		58.92		+0.48
20	" "	59.89			48.20	57.57		-0.11
21	" "	60.27				58.33	11.26	+0.27
22	" "	60.10			47.29		12.10	+0.10
23	" "	61.01			46.32		12.16	+1.01
24	" "	58.70			48.47		12.31	-1.30
25	" "	60.06			48.39		11.02	+0.06
26	" "	60.24			47.90		11.35	+0.24
27	" "	59.89			47.73		11.85	-0.11
28	" "	60.24			48.30		10.95	+0.24
29	" "	60.94			47.80		10.73	+0.94
30	" 19	60.47			47.19			+0.47
31	" "	58.86					12.96	-1.14
32	" 20	59.87	56.27			57.78		-0.13
33	" "	59.37		7.42		57.94		-0.63
34	" "	58.66	55.38			59.86		-1.34
35	" "	59.59		7.39		57.73		-0.41
36	" "	59.53	55.31			59.06		-0.47
37	" "	60.20		6.14		58.38		+0.20
38	" "	59.58	56.27			58.07		-0.42
39	" "	60.00		7.25		57.47		0.00
40	" "	60.35			48.46	56.85		+0.35
41	" "	60.26			47.41	57.99		+0.26
42	" "	58.90					12.92	-1.10
43	" "	59.57					12.27	-0.43
44	" "	59.17					12.65	-0.83
45	" "	59.67					12.16	-0.33
46	" "	58.85			47.16		13.47	-1.15
47	" "	59.71	57.08			57.11		-0.29
48	" "	61.11	55.56				11.06	+1.11
49	" "	60.16	55.73					+0.16
50	" 21	59.94		6.75				-0.06
51	" "	59.52	56.64	6.43				-0.48
52	" "	59.38	56.60	6.60				-0.62
53	" "	59.53	56.82	6.25				-0.47
54	" "	60.24		6.47				+0.24
55	" "	60.37		6.32				+0.37
56	" "	61.27	55.63	5.68				+1.27
57	" "	60.81	55.65	6.13				+0.81
58	" "	59.30	57.29	6.00				-0.70
59	" 22	58.84		7.86				-1.16
60	" "	60.06		6.64				+0.06
61	" "	59.22		7.48				-0.78
62	" "	60.48	56.54	5.57				+0.48
63	" "	59.96	55.93					-0.04
Means		59.98	55.91	6.66	47.79	57.93	11.85	
No. of Observations		63	22	23	25	19	23	
Reciprocal of Weight		0.027	0.129	0.040	0.060	0.068	0.087	

3.

From the observations given in the preceding section, we have to determine the relative bearings and distances of the stations, basing them upon the published positions of Taur, Caherbarnagh, Hungry Hill, Baurtregaum, and Bencorr. Referring to the "*Account of the Principal Triangulation*" we adopt the

bearing of Baurtregaum at Bencorr as found at pages 82, 373.

" Hungry Hill at Caherbarnagh "	" "	92, 374.
" Baurtregaum " "	" "	92, 374.
" Taur " "	" "	92, 374.
" Caherbarnagh at Taur "	" "	157, 373.
" Baurtregaum " "	" "	157, 373.
" Baurtregaum at Hungry Hill "	" "	120, 374.
" Caherbarnagh " "	" "	120, 374.
" Bencorr at Baurtregaum "	" "	76, 373.
" Taur " "	" "	76, 373.
" Caherbarnagh " "	" "	76, 373.
" Hungry Hill " "	" "	76, 373.

Log ratio of distances of Bencorr and }
Hungry Hill from Baurtregaum - } " " 432.

We omit the angle observed at Brandon between Knocknadober and Baurtregaum, as, observed with an inferior instrument, it would not help to increase the weight of our results.

The already fixed points are represented by accented letters, as in Plate XVI. of the "*Account of the Principal Triangulation*," and the others as follows:—

Brandon	H	Knocknadober.....	K
Knocknagante	L	Feaghmain	G
Kilbeg	N	Gurrana	M
Knightstown	O		

For the fixation of these seven points with reference to others, we have 19 equations of condition which are as follows:—

- I. $F'C'K + KF'C' + C'KF' = 180^\circ + \epsilon_1$
- II. $CLF' + F'C'L + LF'C' = 180^\circ + \epsilon_2$
- III. $CLK + KC'L + LKC' = 180^\circ + \epsilon_3$
- IV. $C'GL + LC'G + GLC' = 180^\circ + \epsilon_4$
- V. $KGL + LKG + GLK = 180^\circ + \epsilon_5$
- VI. $KML + LKM + MLK = 180^\circ + \epsilon_6$
- VII. $KMG + GKM + MGK = 180^\circ + \epsilon_7$
- VIII. $NGM + MNG + GMN = 180^\circ + \epsilon_8$
- IX. $NKM + MNK + KMN = 180^\circ + \epsilon_9$
- X. $\frac{A'C' \sin C'HF' \sin C'A'H}{C'F' \sin C'F'H \sin C'HA'} = 1$
- XI. $\frac{\sin C'HF' \sin C'D'H \sin C'F'D'}{\sin C'F'H \sin C'HD' \sin C'D'F'} = 1$
- XII. $\frac{\sin C'E'H \sin C'D'E' \sin C'HD}{\sin C'HE' \sin C'E'D' \sin C'DH'} = 1$
- XIII. $\frac{\sin HKF' \sin HC'K \sin HF'C'}{\sin HF'K \sin HKC' \sin HC'F'} = 1$
- XIV. $\frac{\sin LKC' \sin LF'K \sin LCF'}{\sin LC'K \sin LKF' \sin LF'C'} = 1$

$$\begin{array}{lcl}
 \text{XV.} & \frac{\sin HCK \sin HGC \sin HKG}{\sin HKC \sin HCG \sin HGK} & = 1 \\
 \text{XVI.} & \frac{\sin KGL \sin KHG \sin KC'H \sin KLC'}{\sin KLG \sin KGH \sin KHC' \sin KC'L} & = 1 \\
 \text{XVII.} & \frac{\sin MLK \sin MGL \sin MKG}{\sin MKL \sin MLG \sin MGK} & = 1 \\
 \text{XVIII.} & \frac{\sin NKG \sin NMK \sin NGM}{\sin NGK \sin NKM \sin NMG} & = 1 \\
 \text{XIX.} & \frac{\sin OGN \sin OMG \sin ONM}{\sin ONG \sin OGM \sin OMN} & = 1
 \end{array}$$

In forming the numerical Equations of Condition from these, we suppose each observed bearing to have a symbolical correction attached. The symbols used are (1) (2)..... For convenience we here bring together the bearings.

Stations.	Bearings.	$\frac{1}{w}$	Stations.	Bearings.	$\frac{1}{w}$
<i>At Bencorr.</i>	o , "		<i>At Knocknagante.</i>	o , "	
Baurtregaum.....	1 1 4.9907		Gurrana.....	84 10 55.91+(11)	0.129
Brandon	12 35 49.98+(1)	2.456	Feaghmain	96 41 6.66+(12)	0.040
<i>At Caherbarnagh.</i>			Knocknadober ...	123 59 47.79+(13)	0.060
Hungry Hill.....	48 5 44.1530		Baurtregaum.....	191 45 57.93+(14)	0.068
Brandon	107 33 17.52+(2)	0.935	Hungry Hill.....	336 41 11.85+(15)	0.086
Baurtregaum.....	113 57 49.9605		<i>At Knocknadober.</i>		
Taur	188 50 3.8358		Gurrana.....	34 34 31.12+(16)	0.133
<i>At Taur.</i>			Kilbeg	49 28 32.74+(17)	0.160
Caherbarnagh ...	8 52 32.2833		Feaghmain	56 25 23.70+(18)	0.240
Baurtregaum.....	86 8 43.8615		Brandon.....	168 38 36.17+(19)	0.706
Brandon	90 11 7.77+(3)	3.993	Baurtregaum.....	224 43 21.13+(20)	0.283
<i>At Hungry Hill.</i>			Knocknagante ...	303 48 41.51+(21)	0.073
Knocknadober ...	142 23 56.96+(4)	0.552	Hungry Hill.....	322 6 17.26+(22)	0.107
Brandon	152 40 53.60+(5)	2.672	<i>At Feaghmain.</i>		
Knocknagante ...	156 47 46.92+(6)	0.261	Brandon	190 14 19.47+(23)	0.287
Baurtregaum.....	177 29 31.2096		Baurtregaum.....	228 2 21.80+(24)	0.185
Caherbarnagh ...	227 36 47.9032		Knocknadober ...	236 16 51.94+(25)	0.088
<i>At Baurtregaum.</i>			Knightstown.....	266 24 32.37+(26)	1.214
Knocknagante ...	11 50 47.01+(7)	1.835	Knocknagante ...	276 21 28.73+(27)	0.109
Knocknadober ...	44 59 17.14+(8)	0.259	Kilbeg	276 56 16.88+(28)	0.035
Feaghmain	48 26 53.59+(9)	1.045	Gurrana.....	338 49 40.04+(29)	0.033
Brandon	96 18 33.84+(10)	0.423	<i>At Gurrana or</i>		
Bencorr	180 59 21.7526		<i>Kilbeg South</i>		
Taur	265 35 26.4109		<i>Meridian Mark.</i>		
Caherbarnagh ...	293 27 3.7354		Feaghmain	158 50 59.99+(30)	0.026
Hungry Hill.....	357 27 47.6560		Kilbeg	179 58 46.85+(31)	0.050
			Knightstown.....	194 23 44.37+(32)	0.293
			Knocknadober ...	214 27 19.90+(33)	0.051
			Knocknagante ...	263 52 38.67+(34)	0.082
			<i>At Kilbeg.</i>		
			Gurrana.....	359 59 9.56+(35)	0.026
			Feaghmain ...	96 58 0.00+(36)	0.015
			Knocknadober ...	229 21 45.56+(37)	0.043
			Knightstown.....	251 48 5.32+(38)	0.488

$$\text{Log. } \frac{A'C'}{C'F'} = 0.39738167.$$

The substitution of these bearings in the Geometrical Equations, gives the following system, in which the unit of the quantities (1) (2) (3)..... is one second of arc.

$$\begin{aligned}
 \text{I. } 0 &= - 3.769 - (4) + (8) - (20) + (22) \\
 \text{II. } 0 &= - 3.734 - (6) + (7) - (14) + (15) \\
 \text{III. } 0 &= - 1.006 - (7) + (8) - (13) + (14) - (20) + (21) \\
 \text{IV. } 0 &= + 2.225 - (7) + (9) - (12) + (14) - (24) + (27) \\
 \text{V. } 0 &= - 0.545 - (12) + (13) + (18) - (21) - (25) + (27) \\
 \text{VI. } 0 &= - 0.580 - (11) + (13) + (16) - (21) - (33) + (34) \\
 \text{VII. } 0 &= + 0.367 - (16) + (18) - (21) + (29) - (30) + (33) \\
 \text{VIII. } 0 &= + 0.437 - (28) + (29) - (30) + (31) - (35) + (36) \\
 \text{IX. } 1 &= - 1.476 - (16) + (17) - (31) + (33) + (35) - (37) \\
 \text{X. } 0 &= + 96.60 - 105.080 (1) + 59.565 (5) - 16.327 (10) \\
 \text{XI. } 0 &= - 796.78 - 298.531 (2) + 59.565 (5) + 97.064 (10) \\
 \text{XII. } 0 &= + 736.86 + 298.531 (2) + 477.925 (3) - 290.889 (10) \\
 \text{XIII. } 0 &= + 112.80 + 116.064 (4) - 161.610 (5) - 16.856 (8) + 20.132 (10) \\
 &\quad + 56.318 (19) - 14.160 (20) - 42.159 (22) \\
 \text{XIV. } 0 &= + 194.30 - 82.021 (4) + 137.756 (6) + 114.353 (7) - 32.247 (8) \\
 &\quad - 4.059 (20) + 67.749 (21) - 63.690 (22) \\
 \text{XV. } 0 &= + 65.49 - 16.856 (8) + 19.059 (9) - 2.195 (10) + 8.601 (18) \\
 &\quad + 5.559 (19) - 14.160 (20) - 6.841 (23) \\
 &\quad + 27.144 (24) - 20.303 (25) \\
 \text{XVI. } 0 &= - 52.79 + 32.247 (7) - 55.701 (8) + 23.454 (10) + 40.774 (12) \\
 &\quad - 49.379 (13) + 8.606 (14) + 52.808 (18) \\
 &\quad - 59.406 (19) + 6.598 (20) + 73.111 (23) \\
 &\quad - 98.135 (25) + 25.025 (27) \\
 \text{XVII. } 0 &= + 37.34 + 69.692 (11) - 94.951 (12) + 25.258 (13) - 52.234 (16) \\
 &\quad + 52.514 (18) - 0.2807 (21) - 4.686 (25) \\
 &\quad - 10.975 (27) + 15.660 (29) \\
 \text{XVIII. } 0 &= + 66.70 + 79.129 (16) - 251.919 (17) + 172.790 (18) + 24.516 (25) \\
 &\quad - 35.763 (28) + 11.247 (29) + 54.482 (30) \\
 &\quad - 85.145 (31) + 30.663 (33) \\
 \text{XIX. } 0 &= + 291.32 - 106.612 (26) + 113.283 (28) - 6.671 (29) - 29.469 (30) \\
 &\quad + 81.910 (31) - 52.441 (32) - 6.916 (35) \\
 &\quad - 44.815 (36) + 51.731 (38)
 \end{aligned}$$

Now besides these conditions we have—

$$w_1 (1)^2 + w_2 (2)^2 + w_3 (3)^2 + \dots w_{38} (38)^2$$

to be made a minimum. Hence by the ordinary process of the differential calculus we obtain the following equations where the Roman numerals are the indeterminate multipliers:

$$\begin{aligned}
 (1) \div 2.456 &= + 105.080 \text{ X} \\
 (2) \div 0.935 &= - 298.531 \text{ XI} + 298.531 \text{ XII} \\
 (3) \div 3.993 &= + 477.925 \text{ XII} \\
 (4) \div 0.552 &= - 1 + 116.063 \text{ XIII} - 82.021 \text{ XIV} \\
 (5) \div 2.672 &= + 59.565 \text{ X} + 59.565 \text{ XI} - 161.610 \text{ XIII} \\
 (6) \div 0.261 &= - 11 + 137.756 \text{ XIV} \\
 (7) \div 1.835 &= + 11 - 111 - 114.353 \text{ XIV} + 32.247 \text{ XVI} \\
 (8) \div 0.259 &= + 1 + 111 - 16.856 \text{ XIII} - 32.247 \text{ XIV} - 16.856 \text{ XV} - 55.701 \text{ XVI} \\
 (9) \div 1.045 &= + 14 + 19.051 \text{ XV}
 \end{aligned}$$

$$(10) \div 0.423 = -16.327 \text{ x} + 97.064 \text{ xi} - 290.889 \text{ xii} - 20.132 \text{ xiii} - 2.195 \text{ xv} \\ + 23.454 \text{ xvi}$$

$$(11) \div 0.129 = -\text{vi} + 69.692 \text{ xvii}$$

$$(12) \div 0.040 = -\text{iv} - \text{v} + 40.774 \text{ xvi} - 94.951 \text{ xvii}$$

$$(13) \div 0.060 = -\text{iii} + \text{v} + \text{vi} - 49.379 \text{ xvi} + 25.258 \text{ xvii}$$

$$(14) \div 0.068 = -\text{ii} + \text{iii} + \text{iv} + 8.606 \text{ xvi}$$

$$(15) \div 0.086 = +\text{ii}$$

$$(16) \div 0.133 = +\text{vi} - \text{vii} - \text{ix} - 52.234 \text{ xvii} + 79.129 \text{ xviii}$$

$$(17) \div 0.160 = +\text{ix} - 251.919 \text{ xviii}$$

$$(18) \div 0.240 = +\text{v} + \text{vii} + 8.601 \text{ xv} + 52.808 \text{ xvi} + 52.514 \text{ xvii} + 172.790 \text{ xviii}$$

$$(19) \div 0.706 = +56.318 \text{ xiii} + 5.559 \text{ xv} - 59.406 \text{ xvi}$$

$$(20) \div 0.283 = -\text{i} - \text{iii} - 14.160 \text{ xiii} - 4.059 \text{ xiv} - 14.160 \text{ xv} + 6.598 \text{ xvi}$$

$$(21) \div 0.073 = +\text{iii} - \text{v} - \text{vi} + 67.749 \text{ xiv} - 0.2807 \text{ xvii}$$

$$(22) \div 0.107 = +\text{i} - 42.159 \text{ xiii} - 63.690 \text{ xiv}$$

$$(23) \div 0.287 = -6.841 \text{ xv} + 73.111 \text{ xvi}$$

$$(24) \div 0.185 = -\text{iv} + 27.144 \text{ xv}$$

$$(25) \div 0.088 = -\text{v} - \text{vii} - 20.303 \text{ xv} - 98.135 \text{ xvi} - 4.686 \text{ xvii} + 24.516 \text{ xviii}$$

$$(26) \div 1.214 = -106.612 \text{ xix}$$

$$(27) \div 0.109 = +\text{iv} + \text{v} + 25.025 \text{ xvi} - 10.975 \text{ xvii}$$

$$(28) \div 0.035 = -\text{viii} - 35.763 \text{ xviii} + 113.283 \text{ xix}$$

$$(29) \div 0.033 = +\text{vii} + \text{viii} + 15.660 \text{ xvii} + 11.247 \text{ xviii} - 6.671 \text{ xix}$$

$$(30) \div 0.026 = -\text{vii} - \text{viii} + 54.482 \text{ xviii} + 29.469 \text{ xix}$$

$$(31) \div 0.050 = +\text{viii} - \text{ix} - 85.145 \text{ xviii} + 81.910 \text{ xix}$$

$$(32) \div 0.293 = -52.441 \text{ xix}$$

$$(33) \div 0.051 = -\text{vi} + \text{vii} + \text{ix} + 30.663 \text{ xviii}$$

$$(34) \div 0.082 = +\text{vi}$$

$$(35) \div 0.026 = -\text{viii} + \text{ix} - 6.916 \text{ xix}$$

$$(36) \div 0.015 = +\text{viii} - 44.815 \text{ xix}$$

$$(37) \div 0.043 = -\text{ix}$$

$$(38) \div 0.488 = +51.731 \text{ xix}$$

From these we have to determine (1) (2) (3) (38) in terms of I. II. III. XIX., and substitute the values so determined in the equations (19 in number) of condition. The resulting equations are tabulated as follows:—

Absolute Term.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.
0 = - 3.769 + 1.201			+ 0.542							
0 = - 3.734		+ 2.250	- 1.903	- 1.903						
0 = - 1.006 + 0.542		- 1.903	+ 2.578	+ 1.903	- 0.133	- 0.133				
0 = + 2.225		- 1.903	+ 1.903	+ 3.282	+ 0.149					
0 = - 0.545			- 0.133	+ 0.149	+ 0.610	+ 0.133	+ 0.328			
0 = - 0.580			- 0.133		+ 0.133	+ 0.528	- 0.184		- 0.184	
0 = + 0.367					+ 0.328	- 0.184	+ 0.571	+ 0.059	+ 0.184	
0 = + 0.437							+ 0.059	+ 0.185	- 0.076	
0 = - 1.476						- 0.184	+ 0.184	- 0.076	+ 0.463	
0 = + 96.60										+ 36711.662
0 = - 796.78										+ 8809.871
0 = + 736.86										+ 2008.973
0 = + 112.80	- 68.9362		- 0.3584							- 28560.510
0 = + 194.30	+ 31.2575	+ 173.8835	- 212.0954	- 209.8378	- 4.9457	- 4.9457				
0 = + 65.49	- 0.3584		- 0.3584	+ 14.8867	+ 3.8509		+ 3.8509			+ 15.1594
0 = - 52.79	- 16.2938	+ 58.5880	- 71.9191	- 57.4913	+ 19.4438	- 2.9627	+ 21.3098			- 161.9809
0 = + 37.34			- 1.5360	+ 2.6018	+ 17.1535	- 14.4014	+ 20.4796	+ 0.5168	+ 6.9471	
0 = + 66.70					+ 39.3122	+ 8.9603	+ 29.3065	- 4.0509	- 45.0101	
0 = + 291.32							+ 0.5460	+ 0.1842	- 4.2753	

continued.

Absolute Term repeated.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.	XVIII.	XIX.
0 = - 3'769			- 68'9362	+ 31'2575	- 0'3584	- 16'2938			
0 = - 3'734				+ 173'8835		+ 58'5880			
0 = - 1'006			- 0'3584	- 212'0954	- 0'3584	- 71'9191	- 1'5360		
0 = + 2'225				- 209'8378	+ 14'8867	- 57'4913	+ 2'6018		
0 = - 0'545				- 4'9457	+ 3'8509	+ 19'4438	+ 17'1535	+ 39'3122	
0 = - 0'580				- 4'9457		- 2'9627	- 14'4014	+ 8'9603	
0 = + 0'367					+ 3'8509	+ 21'3098	+ 20'4796	+ 29'3065	+ 0'5460
0 = + 0'437							+ 0'5168	- 4'0509	+ 0'1842
0 = - 1'476							+ 6'9471	- 45'0101	- 4'2753
0 = + 96'60	+ 8809'871	+ 2008'973	- 25860'51		+ 15'1594	- 161'9809			
0 = - 796'78	+ 96793'42	- 95271'27	- 24894'89		- 90'1225	+ 962'976			
0 = + 736'86	- 95271'27	+ 1031171'3	- 2477'165		+ 270'0861	- 2885'922			
0 = + 112'80	- 24894'89	- 2477'165	+ 79953'71	- 4810'469	+ 332'6678	- 1945'548			
0 = + 194'30			- 4810'469	+ 33705'144	+ 157'0464	+ 7224'273	- 1'3882		
0 = + 65'49	- 90'1225	+ 270'0861	+ 332'6678	+ 157'0464	+ 737'2274	+ 102'6084	+ 116'7738	+ 312'8780	
0 = - 52'79	+ 962'976	- 2885'922	- 1945'5480	+ 7224'273	+ 102'6084	+ 8785'2063	+ 446'3949	+ 1978'2091	
0 = + 37'34				- 1'3882	+ 116'7738	+ 446'3949	+ 2073'3442	+ 1623'7183	- 3'4474
0 = + 66'70					+ 312'8780	+ 1978'2091	+ 1623'7183	+ 18741'8463	- 534'7279
0 = + 291'32							- 3'4474	- 534'7279	+ 16750'2058

By the solution of these equations we obtain I. II. XIX., and from them again we readily derive the values of (1) (2) (38). The results are as follows:—

Log. I = 0.5391512 +
 Log. II = 0.6311751 +
 Log. III = 0.2234202 +
 Log. IV = 9.3727274 -
 Log. V = 0.5763744 +
 Log. VI = 8.7772200 +
 Log. VII = 0.7904544 -
 Log. VIII = 0.5778874 +
 Log. IX = 0.9422666 +
 Log. X = 7.4338995 -
 Log. XI = 9.9616747 +
 Log. XII = 6.3421267 +
 Log. XIII = 7.4540831 +
 Log. XIV = 8.4001569 -
 Log. XV = 8.8482077 -
 Log. XVI = 8.3162444 +
 Log. XVII = 8.5308007 -
 Log. XVIII = 8.3329068 +
 Log. XIX = 8.1558719 -

(1) = - 0.7009	(10) = + 0.6628
(2) = - 2.4941	(11) = - 0.3129
(3) = + 0.4196	(12) = + 0.0213
(4) = - 0.5904	(13) = + 0.0166
(5) = - 0.2036	(14) = - 0.1811
(6) = - 2.0199	(15) = + 0.3679
(7) = + 1.1653	(16) = + 0.1267
(8) = + 1.5359	(17) = + 0.5333
(9) = - 1.6502	(18) = + 0.0053

(19) = - 1.0323	(29) = - 0.0856
(20) = - 1.1141	(30) = + 0.1040
(21) = - 0.2810	(31) = - 0.3986
(22) = + 0.5287	(32) = + 0.2200
(23) = + 0.5730	(33) = + 0.1624
(24) = - 0.3103	(34) = + 0.0049
(25) = + 0.2188	(35) = + 0.1316
(26) = + 1.8531	(36) = + 0.0665
(27) = + 0.4824	(37) = - 0.3764
(28) = - 0.2163	(38) = - 0.3614

4.

We have in the preceding section determined the most probable corrections to the observed bearings. It remains now to work out the triangles after applying the computed corrections to the observed bearings.

CALCULATION OF TRIANGLES.

Stations.	Spherical Angles.	Seconds of Reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
1.	° ' "	"			
Baurtregaum	84 40 47.250	43.701	9.99812435	5.67698033	475313.70
Bencorr	11 34 44.288	40.740	9.30255060	4.98140658	95809.06
Brandon	83 44 39.107	35.559	9.99740536	5.67626134	474527.45
2.	180 0 10.645				
Baurtregaum	98 50 46.847	45.436	9.99480325	5.35336164	225611.71
Hungry Hill	24 48 37.813	36.403	9.62284819	4.98140658	95809.06
Brandon	56 20 39.572	38.161	9.92032128	5.27887967	190055.16
3.	180 0 4.232				
Caherbarnagh	59 27 30.873	27.676	9.93513131	5.35336164	225611.71
Hungry Hill	74 55 54.507	51.309	9.98480314	5.40303347	252949.29
Brandon	45 36 44.213	41.015	9.85407018	5.27230051	187197.70
4.	180 0 9.593				
Caherbarnagh	81 16 48.810	47.309	9.99495054	5.40299894	252929.18
Brandon	17 24 39.786	38.285	9.47498758	4.88403598	76566.00
Taur	81 18 35.906	34.406	9.99498507	5.40303347	252949.29
5.	180 0 4.502				
Baurtregaum	47 31 31.020	29.809	9.86780408	5.15029874	141350.95
Hungry Hill	35 5 34.840	33.629	9.75959280	5.04208746	110176.12
Knocknadober	97 22 57.773	56.562	9.99638501	5.27887967	190055.16
	180 0 3.633				

Stations.	Spherical Angles.	Seconds of Reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
6.	° ' "	"			
Baurtregaum	51 19 15.827	15.181	9.89246095	4.95489025	90134.33
Brandon	72 36 1.233	0.587	9.97965816	5.04208746	110176.12
Knocknadober.....	56 4 44.878	44.232	9.91897728	4.98140658	95809.06
	180 0 1.938				
7.					
Hungry Hill	10 16 57.027	56.580	9.25163747	4.95489025	90134.33
Brandon	16 15 21.661	21.215	9.44704596	5.15029874	141350.95
Knocknadober.....	153 27 42.651	42.205	9.65010886	5.35336164	225611.71
	180 0 1.339				
8.					
Baurtregaum	14 23 0.519	0.087	9.39516651	4.91459626	82147.86
Hungry Hill	20 41 46.310	45.877	9.54827980	5.06770955	116871.75
Knocknagante.....	144 55 14.469	14.036	9.75944992	5.27887967	190055.16
	180 0 1.298				
9.					
Baurtregaum	33 8 30.501	29.949	9.73775767	4.81338995	65071.37
Knocknadober.....	79 5 21.213	20.661	9.99207727	5.06770955	116871.75
Knocknagante.....	67 46 9.942	9.390	9.96645518	5.04208746	110176.12
	180 0 1.656				
10.					
Hungry Hill	14 23 48.530	48.304	9.39556220	4.81338995	65071.37
Knocknadober.....	18 17 36.560	36.333	9.49676851	4.91459626	82147.86
Knocknagante.....	147 18 35.589	35.363	9.73247099	5.15029874	141350.95
	180 0 0.679				
11.					
Baurtregaum	47 51 42.563	41.695	9.87012646	5.06413685	115914.25
Brandon	94 20 18.595	17.727	9.99875389	5.19276428	155870.63
Feaghmain	37 48 1.447	0.578	9.78739619	4.98140658	95809.06
	180 0 2.605				
12.					
Baurtregaum	36 36 3.764	2.913	9.77541835	4.96989230	93302.29
Knocknagante.....	95 4 51.068	50.216	9.99829033	5.19276428	155870.63
Feaghmain	48 19 7.723	6.871	9.87323560	5.06770955	116871.75
	180 0 2.555				
13.					
Knocknadober.....	112 13 11.432	11.129	9.96648914	5.06413685	115914.25
Brandon	21 44 17.362	17.059	9.56862884	4.66627655	46374.21
Feaghmain	46 2 32.116	31.812	9.85724254	4.95489025	90134.33
	180 0 0.910				
14.					
Knocknadober.....	112 36 42.476	42.258	9.96526355	4.96989230	93302.29
Knocknagante.....	27 18 41.125	40.907	9.66164780	4.66627655	46374.21
Feaghmain	40 4 37.054	36.835	9.80876120	4.81338995	65071.37
	180 0 0.655				

Stations.	Spherical Angles.	Seconds of Reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
15.	° ' "	"			
Knocknadober.....	90 45 50.018	49.738	9.99996141	4.93281306	85666.90
Knocknagante.....	39 48 52.210	51.930	9.80638561	4.73923726	54857.66
Gurrana	49 25 18.612	18.332	9.88053830	4.81338995	65071.37
	180 0 0.840				
16.					
Knocknadober.....	21 50 52.459	52.384	9.57071065	4.32044483	20914.37
Feaghmain	102 32 47.796	47.722	9.98950308	4.73923726	54857.66
Gurrana	55 36 19.968	19.894	9.91654237	4.66627655	46374.21
	180 0 0.223				
17.					
Feaghmain	62 28 10.742	10.606	9.94780894	4.93281306	85666.90
Knocknagante.....	12 30 11.084	10.949	9.33544072	4.32044484	20914.37
Gurrana	105 1 38.581	38.445	9.98488818	4.96989230	93302.29
	180 0 0.407				
18.					
Feaghmain	61 53 23.291	23.280	9.94548976	4.26916591	18585.14
Gurrana	21 7 46.367	46.356	9.55687855	3.88055470	7595.47
Kilbeg	96 58 50.375	50.364	9.99676869	4.32044484	20914.37
	180 0 0.033				
19.					
Knocknadober.....	14 54 2.027	1.981	9.41017315	4.26916591	18585.14
Gurrana	34 28 33.601	33.556	9.75286308	4.61185584	40912.48
Kilbeg	130 37 24.508	24.463	9.88024450	4.73923726	54857.66
	180 0 0.136				
20.					
Knocknadober.....	6 56 50.432	50.414	9.08263102	3.88055469	7595.47
Feaghmain	40 39 24.505	24.487	9.81393217	4.61185584	40912.48
Kilbeg	132 23 45.117	45.099	9.86835288	4.66627655	46374.21
	180 0 0.054				
21.					
Feaghmain	72 25 5.731	5.711	9.97922364	4.32137344	20959.14
Gurrana	35 32 44.496	44.476	9.76443913	4.10658893	12781.71
Knightstown	72 2 9.833	9.813	9.97829504	4.32044484	20914.37
	180 0 0.060				
22.					
Kilbeg	108 11 4.733	4.725	9.97774907	4.32137344	20959.14
Gurrana	14 24 58.129	58.121	9.39613447	3.73975884	5492.36
Knightstown	57 23 57.161	57.154	9.92554154	4.26916591	18585.14
	180 0 0.023				

We can now readily obtain the change of position obtained from these observations as compared with that given in the "*Account of the Principal Triangulation.*" In the latter, the angle at Baurtregaum between Hungry Hill and Feaghmain was obtained (pages 76, 404, 373), as—

$$50^{\circ} 59' 4''.2213$$

And the distance Baurtregaum Feaghmain as—

$$155875.29$$

In the present determination the above angle and distance are—

$$50^{\circ} 59' 4''.2838$$

$$155870.63$$

The difference of the angles is $0''.0625$, which at the distance of 155870 feet corresponds to a displacement of—

$$155870 \sin (0^{\circ} 0' 0''.0625) = .0472 \text{ feet,}$$

also the difference of the distances from Baurtregaum is 4.66 feet. Therefore, to find the new position with reference to the old, take 4.66 feet in a north-east direction making $48^{\circ} 2'$ with the north, and then in a direction perpendicular to this, measure 0.047 feet (north-west), this will give the new position.

Or, measuring in directions east and north, the new position of Feaghmain is 3.44 feet east and 3.15 feet north of the old.

5.

The first thirteen triangles in the table of triangles, pp. 40, 41 of the "*Extension of the Triangulation into France and Belgium*," will remain as they are printed. The last triangle alone will be altered, and will stand thus:—

Stations.	Spherical Angles.	Seconds of reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
Baurtregaum	$41^{\circ} 43' 33''.210$	32.359	9.82319022	5.01869243	104398.06
Feaghmain	$41^{\circ} 50' 51''.720$	50.869	9.82422335	5.01972557	
G	$96^{\circ} 25' 37''.624$	36.772	9.99726207	5.19276428	

Now the angle Baurtregaum : G : F is $83^{\circ} 34' 13''.768$, and adding this to the angle Baurtregaum : G : Feaghmain above, the sum of the two falls short of 180° by $8''.608$. From Feaghmain let a perpendicular be drawn to the line F G from Greenwich, intersecting this line in Q, then we have two triangles as follows:—

Stations.	Spherical Angles.	Seconds of reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
Feaghmain	$89^{\circ} 59' 51''.3921$		10.00000000	5.01869243	
G	$0^{\circ} 0' 8''.6080$		5.62048	0.63917	
Q	$90^{\circ} 0' 0''.0000$		10.00000000	5.01869243	
	$180^{\circ} 0' 0''.0001$				
Q	$90^{\circ} 0' 0''.0000$	59.9992	10.00000000	6.37108677	2350102.30
Greenwich	$0^{\circ} 0' 0''.3832$	.3824	4.26808	0.63917	4.36
Feaghmain	$89^{\circ} 59' 59''.6192$	59.6184	10.00000000	6.37108677	2350102.30
	$180^{\circ} 0' 0''.0024$				

These two triangles give us the angle at Feaghmain between the point G and Greenwich, being the difference between the two angles at Feaghmain,

$$\text{Greenwich, Feaghmain, Q} = 89^{\circ} 59' 59''.6192$$

$$\text{G, Feaghmain, Q} = 89^{\circ} 59' 51''.3921$$

$$\text{Greenwich, Feaghmain, G} = 0^{\circ} 0' 8''.2271$$

Now the angle Baurtregaum, Feaghmain, G we have shewn in the first of the three triangles just given, to be $41^{\circ} 50' 51''.720$, consequently taking away $8''.227$, the angle—

$$\text{Baurtregaum, Feaghmain, Greenwich} = 41^{\circ} 50' 43''.493$$

We shall here repeat the results shewn pages 40, 41 of the account of the "*Extension of the Triangulation into France and Belgium*," the eighth or last distance being not that there given, but as now revised:—

Greenwich to A	386140.49*
A to B	232596.47
B to C	136657.46
C to D	343138.07
D to E	436909.57
E to F	243085.54
F to G	467176.64
Feaghmain to G	104398.06

$$\text{Greenwich to Feaghmain} = 2350102.30$$

The angle Arbury, Greenwich, G was taken as

$$37^{\circ} 22' 32''.019$$

if from this we deduct the angle G, Greenwich, Feaghmain, found above as $0''.3832$, we get

$$37^{\circ} 22' 31''.636$$

as the angle at Greenwich between Arbury and Feaghmain. If to this we add the angle between Chingford and Arbury at Greenwich, ("*Account of the Principal Triangulation*," p. 498,) we get the angle Chingford, Greenwich, Feaghmain as $81^{\circ} 59' 11''.857$.

The following data, therefore, are afforded by the *Triangulation*, independent of any assumption of the figure of the Earth:—

$$\text{GREENWICH TO FEAGHMAIN} = 2350102.30 \text{ feet}$$

$$\text{CHINGFORD, GREENWICH, FEAGHMAIN} = 81^{\circ} 59' 11''.857$$

6.

The calculation of the spherical triangle at page 49 of the "*Extension, &c.*" will in consequence of the change in the bearing and distance of Feaghmain from Greenwich be slightly modified and stand thus,—

$$\begin{aligned} \log s & \dots\dots 6.37108677 \\ \text{AC log } (n \sin 1'') & \dots\dots 7.99282796 \\ \log (\text{first term of } \theta) & \dots\dots 4.36391473 \end{aligned}$$

* This is erroneously printed 386140.39 in the "*Extension of the Triangulation into France and Belgium*."

$$\begin{array}{rcl}
 \text{First term of } \theta & \dots\dots & 6^\circ 25' 16'' \cdot 1088 \\
 \text{second } ,, & \dots\dots & + \cdot 0025 \\
 \text{third } ,, & \dots\dots & - \cdot 0019 \\
 & & \theta = 6^\circ 25' 16'' \cdot 1094
 \end{array}$$

Here θ is the angle subtended by Greenwich and Feaghmain at the point in which the normal at Greenwich intersects the axis of revolution of the earth. The three lines drawn from this point through Greenwich, Feaghmain, and the north pole of the earth form the triangle we are considering. Let $90 - \lambda$ and $90 - \phi$ be the sides of this triangle opposite respectively to Feaghmain and Greenwich, α the angle at Greenwich, ω the angle opposite the side θ ; then ω is the Longitude of Feaghmain and λ is the Latitude of Greenwich; here used as $51^\circ 28' 39'' \cdot 864$.

$$\begin{array}{rcl}
 \frac{1}{2} (90 - \lambda + \theta) & = & 22^\circ 28' 18'' \cdot 1227 \dots\dots \log \sec = 0 \cdot 03429587 \dots\dots \operatorname{cosec} = 0 \cdot 41767856 \\
 \frac{1}{2} (90 - \lambda - \theta) & = & 16 \quad 3 \quad 2 \cdot 0133 \dots\dots \cos = 9 \cdot 98273156 \dots\dots \sin = 9 \cdot 44167235 \\
 \frac{1}{2} \alpha & = & 40 \quad 59 \quad 36 \cdot 7485 \dots\dots \cot = 0 \cdot 06093582 \dots\dots \cot = 0 \cdot 06093582
 \end{array}$$

$$\begin{array}{rcl}
 50^\circ 6' 55'' \cdot 3757 & & \tan = 0 \cdot 07796325 \quad \tan = 9 \cdot 92028673 \\
 39 \quad 46 \quad 15 \cdot 8002 & &
 \end{array}$$

$$10 \quad 20 \quad 39 \cdot 5755 = \omega = \text{Longitude of Feaghmain.}$$

To obtain the length of the arc of parallel corresponding to this longitude in 52° latitude

$$\begin{array}{l}
 \omega = 37239'' \cdot 5755 \dots \log = 4 \cdot 57100472 \\
 N \sin 1'' \cos 52^\circ \dots \log = 1 \cdot 79652713
 \end{array}$$

$$\text{Arc in feet} = 2330944 \cdot 07 \dots \log = 6 \cdot 36753185$$

This is less than the result already published, page 49 of the "*Extension, &c.*," by 3.43 feet.

The third side of the spherical triangle, namely, that opposite to Greenwich, we easily find to be—

$$\begin{array}{l}
 90 - \phi = 38^\circ 4' 42'' \cdot 2145 \\
 \therefore \phi = 51 \quad 55 \quad 17 \cdot 7855
 \end{array}$$

The difference between this and the latitude of Greenwich is $26' 37'' \cdot 9215$, which multiplied into the normal for Greenwich will give the distance of the parallels of Greenwich and Feaghmain. This distance again divided by the radius of curvature for the mean of the latitudes of Greenwich and Feaghmain will give the true difference of latitude of Greenwich and Feaghmain. Thus finally the latitude of Feaghmain is found to be

$$\lambda' = 51^\circ 55' 21'' \cdot 9580$$

Let α' be the azimuth of Greenwich at Feaghmain, then by a well known theorem—

$$\tan \frac{\alpha' + \alpha}{2} = \frac{\cos \frac{\lambda' - \lambda}{2}}{\sin \frac{\lambda' + \lambda}{2}} \cot \frac{\omega}{2}$$

by this we get

$$\alpha' + \alpha = 171^\circ 32' 24'' \cdot 45$$

Subtracting from this the value of α , we get for α' or the azimuth of Greenwich at Feaghmain—

$$89^\circ 53' 10'' \cdot 94$$

This, it is to be remembered, is the azimuth of Greenwich at Feaghmain on the supposition that the network of the British and Irish Triangulation as a whole is projected on to a spheroid whose semiaxes are

$$a = 20926348$$

$$b = 20855233$$

in such a manner that the sum of the squares of the differences between the observed and computed *latitudes* and *azimuths* is a minimum.

On this same supposition we may continue the calculation on page 50 of the "*Extension, &c.*," and obtain, in precisely the same manner as above, the latitude of Mount Kemmel,

$$50^{\circ} 46' 44'' \cdot 089$$

and the azimuth of Greenwich at Mount Kemmel,

$$67^{\circ} 22' 25'' \cdot 63$$

Having found the azimuth of Greenwich at Feaghmain we proceed to find the azimuth of Kilbeg and Knightstown at Feaghmain as follows: the angle

$$\text{Baurtregaum, Feaghmain, Greenwich} = 41^{\circ} 50' 43'' \cdot 493$$

The corrected bearings of Baurtregaum, Knightstown, and Kilbeg at Feaghmain we have found to be—

$$\text{Baurtregaum} \dots\dots 228^{\circ} 2' 21'' \cdot 80 + (24) = 228^{\circ} 2' 21'' \cdot 490$$

$$\text{Knightstown} \dots\dots 266 24 32 \cdot 37 + (26) = 266 24 34 \cdot 223$$

$$\text{Kilbeg} \dots\dots\dots 276 56 16 \cdot 88 + (28) = 276 56 16 \cdot 664$$

Hence we have the angles

$$\text{Baurtregaum, Feaghmain, Knightstown} = 38^{\circ} 22' 12'' \cdot 733$$

$$\text{Baurtregaum, Feaghmain, Kilbeg} = 48 53 55 \cdot 174$$

$$\therefore \text{Knightstown, Feaghmain, Greenwich} = 3 28 30 \cdot 760$$

$$\text{Kilbeg, Feaghmain, Greenwich} = 7 3 11 \cdot 681$$

Adding and subtracting these last angles from the value we obtained above for the azimuth of Greenwich at Feaghmain we get—

$$\text{Azimuth of Knightstown} \dots\dots 86^{\circ} 24' 40'' \cdot 18$$

$$\text{,, Kilbeg} \dots\dots\dots 96 56 22 \cdot 62$$

From these azimuths and the distances which have already been given we have to compute, using the same elements of the figure of the earth, the latitude, longitude, &c. of Knightstown and Kilbeg. The following results will be easily verified.

Stations.	Latitude.	Longitude.	Az. of Feaghmain.
Kilbeg	$51^{\circ} 51' 12'' \cdot 89$	$10^{\circ} 18' 39'' \cdot 33$	$83^{\circ} 2' 2'' \cdot 73$
Knightstown ...	$51 55 29 \cdot 80$	$10 17 16 \cdot 11$	$93 32 39 \cdot 66$

7.

We have now computed the direction of the meridian at Kilbeg and at Mount Kemmel, also the longitudes of Feaghmain and Knightstown, and we shall next compare them with the observed quantities.

The angle at Kilbeg between Feaghmain and the North Meridian Mark is—

$$(180^{\circ} 0' 13'' \cdot 260) - (96^{\circ} 58' 0'' \cdot 066) = 83^{\circ} 2' 13'' \cdot 194$$

and we have found that the azimuth of Feaghmain at Kilbeg is $83^{\circ} 2' 2'' \cdot 73$; hence the North Meridian Mark is $10'' \cdot 46$ East of North.

Now from special transit observations on the nights of July 26, 27, 29, August 1, 2, 4, 5, 8, made at Kilbeg, the true azimuth of the North Meridian Mark is found to be—

$$0^{\circ} 0' 5'' \cdot 79 \pm 0 \cdot 45 \text{ East of North.}$$

The observed azimuth here is less than the computed by $4'' \cdot 67$.

The longitude of Feaghmain we have found to be $10^{\circ} 20' 39'' \cdot 58$; the observed was—

$$10^{\circ} 20' 48'' \cdot 45$$

The observed longitude here exceeds the computed by $8'' \cdot 87$.

The computed longitude of Knightstown we have found $10^{\circ} 17' 16'' \cdot 11$. The observed value given by Mr. Airy is $41^m 9^s \cdot 81$ or $10^{\circ} 17' 27'' \cdot 15$, this exceeds the computed by $11'' \cdot 04$.

Thus while the longitudes differ considerably from the computed values, the observed azimuth does not differ so much from the computed. This we shall now see to be as it ought.

We shall show in section 9. that the local peculiarities of the ground would account for a deflection of $0'' \cdot 62$ to the east at Feaghmain; of $0'' \cdot 94$ to the west at Kilbeg; and of $0'' \cdot 33$ to the west at Knightstown. Now suppose that from some unknown cause there should be a general deflection $= \eta$ to the east common to all these three stations, so that the absolute amounts become

$$\eta + 0 \cdot 62; \eta - 0 \cdot 94; \eta - 0 \cdot 33$$

This would lead us to expect to find the observed longitudes greater than the computed by

$$1 \cdot 621 \eta + 1'' \cdot 00 \text{ at Feaghmain.}$$

$$1 \cdot 621 \eta - 0 \cdot 53 \text{ at Knightstown.}$$

And the observed azimuth of the meridian mark at Kilbeg too *small* by

$$1 \cdot 276 \eta - 1'' \cdot 20$$

hence

$$1 \cdot 621 \eta + 1 \cdot 00 = 8 \cdot 87$$

$$1 \cdot 276 \eta - 1 \cdot 20 = 4 \cdot 67$$

$$1 \cdot 621 \eta - 0 \cdot 53 = 11 \cdot 04$$

These equations are not absolutely consistent. The first gives $\eta = 4 \cdot 86$, the second $\eta = 4 \cdot 60$, and the third $\eta = 7 \cdot 14$, the mean of which $= 5 \cdot 53$. If there were really a general deflection of this amount to the east common to all the stations, the local deflection would be at Feaghmain $6'' \cdot 15$ east, Kilbeg $4'' \cdot 59$ east, Knightstown $5'' \cdot 20$ east, and these would make the observed longitude of Feaghmain too large by $9'' \cdot 97$, the observed azimuth of the meridian mark at Kilbeg too small by $5'' \cdot 86$, and the observed longitude of Knightstown too large by $8'' \cdot 43$.

We have here a satisfactory proof of the close agreement of the azimuth and longitude determinations at these three points, whatever be the figure of the earth.

For the azimuth at Mount Kemmel we have from the account of the "*Extension, &c.*" the angles

$$\text{Dunkirk, Mt. Kemmel, St. Inglevert} = 35^{\circ} 13' 27'' \cdot 795, \text{ p. } 36$$

$$\text{St. Peters, Mt. Kemmel, St. Inglevert} = 26 \quad 24 \quad 44 \cdot 717 \quad "$$

$$\therefore \text{St. Peters, Mt. Kemmel, Dunkirk} = 8 \quad 48 \quad 43 \cdot 078$$

$$\text{St. Peters, Mt. Kemmel, Greenwich} = 11 \quad 38 \quad 3 \cdot 437, \text{ p. } 43$$

$$\therefore \text{Dunkirk, Mt. Kemmel, Greenwich} = 20 \quad 26 \quad 46 \cdot 515$$

Taking away this last angle from the azimuth of Greenwich at Mt. Kemmel, viz., $67^{\circ} 22' 25'' \cdot 63$, we get the azimuth of Dunkirk at Mt. Kemmel

$$= 46^{\circ} 55' 39'' \cdot 12$$

Now the angle at Mt. Kemmel between the referring object for stars, and Dunkirk is (pp. 26, 28, 32) $96^{\circ} 41' 4'' \cdot 26$, hence the azimuth of the referring object is $143^{\circ} 36' 43'' \cdot 38$ from the north, or $36^{\circ} 23' 16'' \cdot 62$ from the south towards the west.

The observed azimuth is (see pages 38, 39) $36^{\circ} 23' 16'' \cdot 14$.

The discordance here is only $0'' \cdot 48$.

8.

The final result given at page 52 ("*Extension, &c.*") for the length of the arc of parallel should in consequence of the revision of the triangulation in the vicinity of Feaghmain stand thus:—The semi-axes of the Earth being $20926348 + \delta a$ and $20855233 + \delta b$ feet, the length of the arc of parallel in latitude 52° between Feaghmain and Greenwich, and Greenwich and Mt. Kemmel, is

$$\begin{aligned} \text{FEAGHMAIN, GREENWICH} & \dots\dots\dots 2330944 \cdot 07 + 0 \cdot 00623 \delta a - 0 \cdot 00056 \delta b \\ \text{GREENWICH, MT. KEMMEL} & \dots\dots\dots 634157 \cdot 39 + 0 \cdot 00269 \delta a - 0 \cdot 00056 \delta b \\ \text{FEAGHMAIN TO MT. KEMMEL} & \dots\dots\dots 2965101 \cdot 40 + 0 \cdot 00892 \delta a - 0 \cdot 00112 \delta b \end{aligned}$$

9.

In order to ascertain with some precision the amount of disturbing effect on observed latitudes, longitudes, and azimuths that might be expected from the irregularities of the ground in the Island of Valentia and the neighbouring shores, a contour survey of the ground was specially made. The contours are shown in Plate II. From this map we may compute the actual deflection of the plumb-line at each of our three stations in magnitude and direction, so far as they result from visible causes. It has been shown not only in this country but in Russia that the deviation of the plumb-line does not necessarily accord with the indications of the external features of the ground; there are secret, and as yet unknown, causes at work, which equally with, if not in a greater degree than, the external irregularities, influence the local direction of gravity. We cannot therefore actually compute the disturbance at any given place, but it is nevertheless of considerable interest to ascertain what amount is due to visible causes.

Imagine a solid bounded by the horizontal plane $z = 0$, the vertical planes $y = x \tan \alpha$, and $y = x \tan \alpha'$, the cylindrical surfaces $x^2 + y^2 = r^2$, $x^2 + y^2 = r'^2$, and the horizontal plane $z = h$. If we pass to polar co-ordinates $r = \sqrt{x^2 + y^2}$, $\alpha = \tan^{-1} \frac{y}{x}$, we shall find for the attraction of this solid upon a point at the origin

$$\text{in direction } \alpha = 0; \quad \rho \iiint \frac{r^2 d\alpha dr dz}{(r^2 + z^2)^{\frac{3}{2}}} \cos \alpha$$

$$,, \quad \alpha = \frac{\pi}{2}; \quad \rho \iiint \frac{r^2 d\alpha dr dz}{(r^2 + z^2)^{\frac{3}{2}}} \sin \alpha$$

Now if we retain no powers of z above the second

$$\frac{r^2}{(r^2 + z^2)^{\frac{3}{2}}} = \frac{1}{r} - \frac{3}{2} \frac{z^2}{r^3}$$

and the attractions become—

$$\varrho (\sin \alpha' - \sin \alpha_1) \iint \left(\frac{1}{r} - \frac{3}{2} \frac{z^2}{r^3} \right) dr dz$$

$$\varrho (\cos \alpha_1 - \cos \alpha_1) \iint \left(\frac{1}{r} - \frac{3}{2} \frac{z^2}{r^3} \right) dr dz$$

or,

$$2\varrho \sin \frac{\alpha' - \alpha_1}{2} \cos \frac{\alpha' + \alpha_1}{2} \int \left(\frac{h}{r} - \frac{h^3}{2r^3} \right) dr$$

$$2\varrho \sin \frac{\alpha' - \alpha_1}{2} \sin \frac{\alpha' + \alpha_1}{2} \int \left(\frac{h}{r} - \frac{h^3}{2r^3} \right) dr$$

or,

$$2\varrho h \sin \frac{\alpha' - \alpha_1}{2} \cos \frac{\alpha' + \alpha_1}{2} \left(\log_e \frac{r'}{r_1} + \frac{h^2}{4} \left[\frac{1}{r'^2} - \frac{1}{r_1^2} \right] \right)$$

$$2\varrho h \sin \frac{\alpha' - \alpha_1}{2} \sin \frac{\alpha' + \alpha_1}{2} \left(\log_e \frac{r'}{r_1} + \frac{h^2}{4} \left[\frac{1}{r'^2} - \frac{1}{r_1^2} \right] \right)$$

These are the horizontal components of the attraction of the mass upon a point at the origin, in the directions $\alpha = 0$ and $\alpha = \frac{\pi}{2}$.

Now the term in h^2 may be neglected with reference to $\log_e r' - \log_e r_1$; for when $r' : r_1$ is not very far from equality, we have approximately

$$\log_e \frac{r'}{r_1} = 2 \frac{\frac{1}{r_1} - \frac{1}{r'}}{\frac{1}{r_1} + \frac{1}{r'}}$$

The ratio of the term in h^2 to this is

$$\frac{h^2}{8} \left(\frac{1}{r_1} + \frac{1}{r'} \right)^2$$

which is half the tangent squared of the apparent elevation of the middle point of the upper surface of the solid. This term is in every case so small in comparison with the principal term that we shall omit it.

It is shown at page 576 of the "*Account of the Principal Triangulation*" that if the attraction of the mass be A , the deflection of the plumb-line will be

$$\frac{12'' \cdot 447 A}{\delta}$$

where δ is the mean density of the earth. We shall assume $2\varrho = \delta$, that is, take the superficial rocks at Valentia to be about half the mean density of the earth. Then if the height be expressed in feet, the deflections of the plumb-line will be expressed by

$$\frac{12'' \cdot 447}{5280} h \sin \frac{\alpha' - \alpha_1}{2} \cos \frac{\alpha' + \alpha_1}{2} \log_e \frac{r'}{r_1}$$

$$\frac{12'' \cdot 447}{5280} h \sin \frac{\alpha' - \alpha_1}{2} \sin \frac{\alpha' + \alpha_1}{2} \log_e \frac{r'}{r_1}$$

We shall compute the deflection at each station in the south and west direction, in the

following manner: Concentric with the station draw on the map a series of ten circles having their radii in geometric progression, as follows:

$$202, 336, 560, 933, 1555, 2592, 4320, 7200, 12000, 20000$$

feet: the ratio of each radius to the next following being 3:5. Through the station draw 48 radial lines dividing the 360° into 48 equal angles: each quadrant into 12 equal angles. The angle made by the n^{th} line from the south is to be

$$\frac{\pi}{48} (2n - 1)$$

with the south meridian line.

For the n^{th} sector, which lies between the n^{th} and $(n - 1)^{\text{th}}$ radial lines, we have

$$\alpha' = \frac{\pi}{48} (2n - 1)$$

$$\alpha_1 = \frac{\pi}{48} (2n - 3)$$

$$\frac{1}{2} (\alpha' - \alpha_1) = \frac{\pi}{48}$$

$$\frac{1}{2} (\alpha' + \alpha_1) = \frac{\pi}{24} (n - 1)$$

We have divided the ground for a distance of nearly four miles round each station into $9 \times 48 = 432$ compartments; we have next to find the *mean height* of each compartment from the contoured map, and in some cases the mean depth of water. This last has been obtained from an examination of the Admiralty charts. The effect of a depth of water Δ is equivalent, if the mean density of the earth be 5.5, to a hollow of depth $= \frac{7}{11} \Delta$.

If then H be the sum of the mean heights of the nine compartments of the n^{th} sector the deflections in a south and west direction due to the elevations of ground in that sector will be—

$$\text{Deflection South} = \frac{12'' \cdot 447}{5280} \sin \frac{\pi}{48} \log_e \frac{5}{3} \cdot H \cos (n - 1) \frac{\pi}{24}$$

$$\text{Deflection West} = \frac{12'' \cdot 447}{5280} \sin \frac{\pi}{48} \log_e \frac{5}{3} \cdot H \sin (n - 1) \frac{\pi}{24}$$

Now

$$\log_e \frac{5}{3} = 2 \left(\frac{1}{4} + \frac{1}{3 \cdot 4^3} + \frac{1}{5 \cdot 4^5} + \dots \right) = .51083;$$

therefore the total deflection at the station will be

$$\text{Deflection South} = 0'' \cdot 000078760 \Sigma H \cdot \cos (n - 1) \frac{\pi}{24}$$

$$\text{Deflection West} = 0'' \cdot 000078760 \Sigma H \sin (n - 1) \frac{\pi}{24}$$

The following Tables contain the mean heights of the compartments round the three stations. The figures in smaller type are depths of sea. The last two columns are computed from the formulæ just written down.

FEAGHMAIN.

	Azimuth of Sector.	Circles.									H.	Deflection South.	Deflection West.
		1-2.	2-3.	3-4.	4-5.	5-6.	6-7.	7-8.	8-9.	9-10.			
South	0°	870	820	740	600	450	290	150	23	240	4183	+0°3295	+0°0000
	7½	870	820	745	610	455	310	185	40	100	4135	+0°3229	+0°0425
	15	870	820	750	630	475	345	195	70	100	4255	+0°3237	+0°0867
	22½	870	820	755	650	500	385	220	150	105	4455	+0°3242	+0°1343
	30	870	820	760	670	520	430	290	200	80	4640	+0°3165	+0°1827
	37½	875	825	775	690	550	490	360	280	71	4916	+0°3072	+0°2357
	45	875	830	780	720	600	545	390	195	115	5050	+0°2812	+0°2812
	52½	875	840	800	740	600	510	300	150	250	5065	+0°2428	+0°3165
	60	875	845	810	750	590	395	250	105	160	4780	+0°1882	+0°3260
	67½	880	850	820	750	540	280	111	49	8	4288	+0°1292	+0°3120
	75	880	860	830	730	490	150	55	40	90	3822	+0°0779	+0°2908
	82½	885	870	830	700	375	40	120	150	190	3342	+0°0344	+0°2610
West	90	885	875	830	690	182	70	140	170	205	3090	0°0000	+0°2434
	97½	885	870	820	650	34	100	145	200	230	2829	-0°0291	+0°2209
	105	885	860	800	600	4	120	170	200	230	2691	-0°0549	+0°2047
	112½	880	860	800	550	60	125	170	210	240	2578	-0°0777	+0°1876
	120	880	850	790	500	60	130	160	200	230	2524	-0°0994	+0°1722
	127½	880	850	790	450	60	120	150	200	230	2486	-0°1192	+0°1553
	135	875	850	790	450	50	120	150	200	220	2494	-0°1389	+0°1389
	142½	875	860	780	500	20	90	150	190	220	2589	-0°1618	+0°1241
	150	875	860	780	550	62	60	150	190	220	2732	-0°1863	+0°1076
	157½	875	865	770	620	360	40	120	190	210	3199	-0°2328	+0°0964
	165	875	865	760	600	330	130	120	170	200	3248	-0°2471	+0°0662
	172½	875	850	760	580	290	95	95	150	200	3167	-0°2473	+0°0326
North	180	875	850	750	550	280	49	100	150	200	3068	-0°2416	0°0000
	187½	875	850	740	550	275	24	75	140	180	3063	-0°2392	-0°0315
	195	875	840	730	530	270	19	85	140	165	3016	-0°2294	-0°0615
	202½	875	820	720	525	280	24	95	140	170	2986	-0°2173	-0°0900
	210	875	816	710	520	290	49	90	130	100	3220	-0°2196	-0°1268
	217½	870	800	700	520	300	54	85	110	336	3456	-0°2159	-0°1657
	225	870	800	710	500	300	44	65	90	205	3330	-0°1854	-0°1854
	232½	865	810	720	490	295	44	20	15	12	3238	-0°1553	-0°2023
	240	865	810	730	510	295	60	40	31	6	3347	-0°1318	-0°2283
	247½	860	815	740	570	350	150	75	12	14	3586	-0°1081	-0°2609
	255	860	820	745	600	450	250	110	30	0	3816	-0°0778	-0°2903
	262½	855	820	750	740	550	360	100	41	24	4240	-0°0436	-0°3311
East	270	855	825	750	675	625	400	180	160	0	4470	0°0000	-0°3521
	277½	855	825	755	670	620	410	300	290	10	4735	+0°0487	-0°3697
	285	855	825	755	665	605	410	500	225	60	4900	+0°0999	-0°3728
	292½	855	825	755	660	570	400	460	145	55	4725	+0°1424	-0°3438
	300	860	820	750	655	530	380	350	90	25	4460	+0°1756	-0°3042
	307½	860	820	745	650	500	325	300	60	30	4290	+0°2057	-0°2681
	315	865	815	740	650	490	300	210	27	60	4157	+0°2315	-0°2315
	322½	865	815	730	645	480	285	150	22	172	4164	+0°2602	-0°1996
	330	870	815	730	640	460	260	150	17	278	4220	+0°2878	-0°1662
	337½	870	815	730	620	450	250	100	7	257	4099	+0°2983	-0°1235
	345	870	820	735	610	450	250	130	12	297	4174	+0°3175	-0°0851
	352½	870	820	740	600	450	260	145	22	446	4353	+0°3399	-0°0447

KILBEG.

	Azimuth of Sector.	Circles.									H	Deflection South.	Deflection West.
		1-2.	2-3.	3-4.	4-5.	5-6.	6-7.	7-8.	8-9.	9-10.			
South	0°	565	555	505	420	290	140	12	58	660	3205	+0°2524	0°0000
	7½	570	560	520	445	305	155	27	22	480	3084	+0°2408	+0°0317
	15	570	565	535	455	320	170	54	11	430	3110	+0°2366	+0°0634
	22½	570	570	550	490	350	200	70	0	295	3095	+0°2252	+0°0933
	30	570	570	560	500	370	230	105	0	90	2995	+0°2043	+0°1179
	37½	570	570	565	520	400	270	145	20	27	3087	+0°1929	+0°1480
	45	570	570	570	535	430	325	150	65	32	3247	+0°1808	+0°1808
	52½	570	570	570	550	450	350	155	110	94	3419	+0°1639	+0°2136
	60	570	570	570	560	490	405	160	160	190	3675	+0°1447	+0°2507
	67½	570	565	565	570	500	430	230	260	185	3875	+0°1168	+0°2820
	75	570	565	565	570	520	425	320	390	150	4075	+0°0831	+0°3100
	82½	565	560	555	530	490	405	430	450	55	4040	+0°0415	+0°3155
West	90	565	555	525	490	410	390	590	420	130	3862	0°0000	+0°3042
	97½	560	550	500	410	290	340	650	283	190	3462	-0°0356	+0°2703
	105	555	540	485	345	200	300	450	119	200	2867	-0°0584	+0°2181
	112½	555	530	480	290	150	220	210	54	180	2374	-0°0716	+0°1727
	120	550	520	465	250	120	210	100	35	180	2135	-0°0841	+0°1456
	127½	550	515	440	200	100	210	0	50	200	1856	-0°0890	+0°1160
	135	550	510	430	190	80	185	20	110	180	1748	-0°0973	+0°0973
	142½	545	500	425	170	40	120	35	120	190	1580	-0°0987	+0°0758
	150	545	500	375	150	2	50	35	120	170	1412	-0°0963	+0°0556
	157½	540	470	350	150	15	0	20	130	175	1294	-0°0942	+0°0390
	165	525	460	350	150	20	30	60	120	160	1237	-0°0941	+0°0252
	172½	520	460	350	160	10	30	35	120	105	1299	-0°1014	+0°0134
North	180	520	460	350	170	26	35	56	80	44	1510	-0°1189	0°0000
	187½	520	460	350	190	27	40	71	10	200	1742	-0°1360	-0°0179
	195	520	460	360	200	0	30	67	20	235	1810	-0°1377	-0°0369
	202½	515	455	350	220	13	30	75	20	240	1836	-0°1336	-0°0553
	210	515	450	340	230	24	30	24	10	108	1666	-0°1136	-0°0656
	217½	510	445	320	230	110	35	30	12	80	1666	-0°1041	-0°0799
	225	510	445	320	230	140	24	35	0	70	1717	-0°0956	-0°0956
	232½	510	450	330	230	150	85	15	7	35	1787	-0°0857	-0°1117
	240	515	455	350	335	170	100	11	10	8	1938	-0°0763	-0°1322
	247½	515	460	390	240	180	110	30	36	80	2041	-0°0615	-0°1485
	255	515	465	410	270	190	110	27	19	200	2206	-0°0450	-0°1678
	262½	520	470	420	300	220	125	22	9	210	2281	-0°0234	-0°1781
East	270	520	475	430	350	230	125	17	12	110	2249	0°0000	-0°1771
	277½	520	475	450	390	240	125	17	10	59	2270	+0°0233	-0°1773
	285	525	470	450	400	240	120	17	6	45	2273	+0°0463	-0°1729
	292½	525	480	455	400	235	115	9	54	55	2328	+0°0702	-0°1694
	300	530	485	460	400	225	110	4	69	60	2343	+0°0923	-0°1598
	307½	530	485	460	400	225	105	0	50	70	2325	+0°1115	-0°1453
	315	535	490	470	400	230	100	0	24	85	2334	+0°1300	-0°1300
	322½	540	500	475	400	230	100	0	39	100	2384	+0°1490	-0°1143
	330	545	515	480	400	240	100	0	34	190	2504	+0°1708	-0°0986
	337½	550	525	485	400	255	110	0	23	235	2583	+0°1879	-0°0779
	345	555	535	490	400	275	120	7	48	390	2820	+0°2145	-0°0575
	352½	560	545	495	405	285	125	12	64	570	3061	+0°2390	-0°0315

KNIGHTSTOWN.

	Azimuth of Sector.	Circles.									H	Deflection South.	Deflection West.
		1-2.	2-3.	3-4.	4-5.	5-6.	6-7.	7-8.	8-9.	9-10.			
South	0	40	40	40	40	35	5	10	40	295	529	0°0417	0°0000
	7½	40	40	40	45	45	15	10	15	425	659	+0°0515	+0°0068
	15	40	40	45	50	60	40	0	12	350	637	+0°0485	+0°0130
	22½	40	40	45	55	80	70	12	12	150	504	+0°0367	+0°0152
	30	40	45	50	60	85	110	60	3	100	548	+0°0374	+0°0216
	37½	40	45	50	65	95	130	100	17	137	679	+0°0424	+0°0326
	45	40	45	50	70	100	175	175	75	6	736	+0°0410	+0°0410
	52½	40	50	55	75	110	190	240	155	45	960	+0°0460	+0°0600
	60	40	50	55	80	115	210	400	235	125	1310	+0°0516	+0°0894
	67½	40	50	60	85	105	200	520	325	225	1610	+0°0485	+0°1172
	75	40	55	65	85	110	175	460	400	350	1740	+0°0355	+0°1324
	82½	40	55	65	85	110	160	200	375	325	1415	+0°0145	+0°1105
West	90	40	50	60	75	100	120	22	290	122	879	0°0000	+0°0692
	97½	40	50	55	65	75	14	3	70	0	372	-0°0038	+0°0290
	105	40	45	50	55	50	20	24	0	65	171	-0°0035	+0°0130
	112½	40	45	50	45	35	25	40	50	130	59	-0°0018	+0°0043
	120	40	40	45	35	14	30	30	80	140	-4	+0°0002	-0°0003
	127½	40	40	40	25	0	9	30	80	150	23	-0°0011	+0°0014
	135	40	35	40	15	20	4	100	80	150	68	-0°0038	+0°0038
	142½	40	35	35	5	25	10	90	80	150	36	-0°0022	+0°0017
	150	40	35	30	2	30	10	48	10	40	94	-0°0064	+0°0037
	157½	40	35	25	5	30	20	6	80	0	151	-0°0110	+0°0046
	165	40	30	20	5	30	20	7	140	70	272	-0°0207	+0°0055
	172½	40	30	15	5	25	20	9	150	80	292	-0°0228	+0°0030
North	180	40	30	10	5	20	15	24	96	100	275	-0°0217	0°0000
	187½	40	30	10	5	20	10	9	54	38	144	-0°0112	-0°0015
	195	40	30	10	5	25	10	15	50	70	165	-0°0126	-0°0034
	202½	40	30	15	5	30	10	15	35	150	232	-0°0169	-0°0070
	210	40	30	15		30	10	0	40	250	350	-0°0239	-0°0138
	217½	40	30	10	2	30	5	7	25	330	418	-0°0261	-0°0200
	225	40	30	5	2	30	5	8	5	180	231	-0°0129	-0°0129
	232½	40	30	5	5	30	1	0	3	50	105	-0°0050	-0°0066
	240	40	30	5	10	30	20	45	13	45	173	-0°0068	-0°0118
	247½	40	30		10	25	15	90	65	355	573	-0°0173	-0°0417
	255	40	30		10	25	0	75	125	515	763	-0°0155	-0°0580
	262½	40	30	2	10	25	10	60	135	710	948	-0°0097	-0°0740
East	270	40	30	5	10	25	12	12	104	425	586	0°0000	-0°0462
	277½	40	30	5	10	20	15	10	84	210	334	+0°0034	-0°0261
	285	40	30	5	10	20	20	10	40	160	237	+0°0048	-0°0180
	292½	40	35	5	10	20	20	10	25	180	247	+0°0074	-0°0180
	300	40	35	10	5	15	20	10	15	150	218	+0°0086	-0°0149
	307½	40	35	15	5	15	22	0	10	115	188	+0°0090	-0°0117
	315	40	35	15	5	10	20	17	25	70	180	+0°0100	-0°0100
	322½	40	35	20	2	10	20	27	65	70	237	+0°0148	-0°0114
	330	40	40	25		5	15	37	105	125	359	+0°0245	-0°0141
	337½	40	40	30	5	5	15	26	90	155	373	+0°0271	-0°0112
	345	40	40	35	20	2	10	0	55	180	362	+0°0275	-0°0074
	352½	40	40	40	40	20	5	10	40	175	385	+0°0301	-0°0040

From the sum of the last two columns in the first Table it appears that there is at Feaghmain a deflection of $1''.626$ to the south and $0''.616$ to the east. The total disturbance therefore amounts to $1''.739$ in a direction making an angle of $20^\circ 45'$ from the south, eastward.

From the sum of the last two columns in the second Table it will be seen that there is at Kilbeg Station a deflection of $1''.466$ to the south and of $0''.939$ to the west. The total disturbance therefore amounts to $1''.741$ in a direction making an angle of $32^\circ 38'$ from the south, westward.

From the sum of the two last columns in the third Table it appears that there is at Knightstown a deflection of $0''.406$ to the south and of $0''.335$ to the west. The total disturbance therefore at this station amounts to $0''.526$ in a direction making an angle of $39^\circ 32'$ with the south, westward.

These are the effects resulting from the disposition of the irregularities of ground in the immediate vicinities of the Station. We have seen above that both the Longitude Observations at Feaghmain and Knightstown and the Astronomical Determination of the Direction of the Meridian at the intermediate Station Kilbeg, concur to indicate a general easterly deflection common to all these points, the magnitude of which is between $5''$ and $6''$. This is, however, a matter in reality dependent on the assumed figure of the earth, the assumption being as explained at the top of page 23. If we suppose the semiaxes of the earth to receive increments δa δb and so become

$$20926348 + \delta a \quad 20855233 + \delta b$$

then the computed longitude of Feaghmain and the azimuth of Greenwich from Feaghmain will receive corresponding increments. As at page 51 of the "*Extension, &c.*," if θ and $90 - \lambda$ be two sides of a spherical triangle including an angle α , and if the opposite angles and the third side be respectively ω , β , and $90 - \phi$, we shall have

$$\begin{aligned} \cos \phi \delta \omega &= \sin \beta \delta \theta + \sin \phi \sin \omega \delta \lambda - \sin \theta \cos \beta \delta \alpha \\ - \cos \phi \delta \beta &= \sin \omega \delta \lambda + \sin \phi \sin \beta \delta \theta + \cos \lambda \cos \omega \delta \alpha \end{aligned}$$

Now it is shown at p.p. 45, 46 of the "*Extension, &c.*" that the increments δa and δb involve an increment of

$$\delta \lambda = + 0.0004456 \delta a - 0.0000008 \delta b$$

to the latitude of Greenwich, and an increment of

$$(- 0.0004007 \delta a + 0.0001590 \delta b) \tan \lambda$$

to the azimuth of all objects observed at Greenwich measured in the direction north, east, south, west. This last quantity is equal to

$$\delta \alpha = - 0.0005033 \delta a + 0.0001997 \delta b$$

Again, since omitting small terms,

$$\theta = \frac{s}{n} = \frac{s}{a} (1 - e^2 \sin^2 \lambda)^{\frac{1}{2}}$$

$$\therefore \delta \theta = - \frac{\theta}{a} \left(2 - \frac{n^2}{a^2} \cos^2 \lambda \right) \delta a + \frac{\theta}{b} \left(1 - \frac{n^2}{a^2} \cos^2 \lambda \right) \delta b$$

the numerical value of which is

$$\delta \theta = - 0.0017790 \delta a + 0.0006767 \delta b$$

These values of $\delta \lambda$, $\delta \alpha$, and $\delta \theta$, which we may write thus

$$\begin{aligned} \delta \lambda &= h \delta a + k \delta b \\ \delta \alpha &= h' \delta a + k' \delta b \\ \delta \theta &= h'' \delta a + k'' \delta b \end{aligned}$$

(the sign of $\delta\alpha$ being changed because the azimuth used in the calculation of Feaghmain from Greenwich is measured in the direction north, west, south, east) being substituted in the expressions for $\delta\omega$ and $\delta\beta$, we get

$$\begin{aligned}\delta\omega &= \left(h \tan \phi \sin \omega - h' \sin \theta \frac{\cos \beta}{\cos \phi} + h, \frac{\sin \beta}{\cos \phi} \right) \delta a \\ &\quad + \left(k \tan \phi \sin \omega - k' \sin \theta \frac{\cos \beta}{\cos \phi} + k, \frac{\sin \beta}{\cos \phi} \right) \delta b \\ \delta\beta &= \left(-h \frac{\sin \omega}{\cos \phi} - h' \cos \lambda \frac{\cos \omega}{\cos \phi} - h, \tan \phi \sin \beta \right) \delta a \\ &\quad + \left(-k \frac{\sin \omega}{\cos \phi} - k' \cos \lambda \frac{\cos \omega}{\cos \phi} - k, \tan \phi \sin \beta \right) \delta b\end{aligned}$$

Substituting further

$$\begin{aligned}\omega &= 10^\circ 20' 39'' \cdot 6 \\ \phi &= 51 \quad 55 \quad 17 \cdot 8 \\ \lambda &= 51 \quad 28 \quad 39 \cdot 9 \\ \beta &= 89 \quad 53 \quad 11 \cdot 2\end{aligned}$$

we have finally

$$\begin{aligned}\delta\omega &= -0.0027824\delta a + 0.0010970\delta b \\ \delta\beta &= +0.0016406\delta a - 0.0006650\delta b\end{aligned}$$

that is, the longitude of Feaghmain, and the azimuth of the meridian mark at Kilbeg, and the longitude of Knightstown, are

$$\begin{aligned}10^\circ 20' 39'' \cdot 58 &- 0.00278\delta a + 0.00110\delta b \\ 10 \quad 46 &+ 0.00164\delta a - 0.00066\delta b \\ 10 \quad 17 \quad 16 \cdot 11 &- 0.00278\delta a + 0.00110\delta b\end{aligned}$$

The observed quantities corrected for deflection are

$$\begin{aligned}10^\circ 20' 48'' \cdot 45 &- (1.621\eta + 1'' \cdot 00) \\ 5 \cdot 79 &+ (1.276\eta - 1 \cdot 20) \\ 10 \quad 17 \quad 27 \cdot 15 &- (1.621\eta - 0 \cdot 53)\end{aligned}$$

Taking the differences of these two sets of equations there results

$$\begin{aligned}1.621\eta - 0.00278\delta a + 0.00110\delta b - 7.87 &= 0 \\ -1.276\eta + 0.00164\delta a - 0.00066\delta b + 5.87 &= 0 \\ 1.621\eta - 0.00278\delta a + 0.00110\delta b - 11.57 &= 0\end{aligned}$$

The second of these equations differs little except by a constant multiplier from the mean of the first and third, which is

$$1.621\eta - 0.00278\delta a + 0.00110\delta b - 9.72 = 0$$

The mean of the three equations divided by the co-efficient of η is

$$\eta - 0.00159\delta a + 0.00063\delta b - 5.60 = 0$$

Our conclusion then is as before, that the two longitude determinations and the azimuth determination are accordant in indicating general easterly deflection in the Island of Valentia; the amount of which can be assigned to accord with any given hypothesis as to the values of the terrestrial semi-axes.

DETERMINATION OF THE POSITION

OF THE

LONGITUDE STATION AT HAVERFORDWEST.

1.

THE station selected by Colonel Forsch for the longitude station is, from its low situation, not readily connected with the Principal Triangulation, of which the nearest points are Precelly and Lundy Island. In order to make the connexion in a satisfactory manner seven intermediate stations were taken up, whose positions will be seen in Plate IV. Over the transit pier (the northern or rectangular pier,—there were two piers in the Observatory, 6 feet 11 inches from centre to centre, and directly north and south of one another) a scaffolding forty feet high had to be erected in order to connect this point with the three adjacent stations, Croft, Cunnagar, and St. Thomas's Church. The whole of the Observations in connexion with this work were made by Sergeant Finch of the Royal Engineers, with Ramsden's eighteen-inch theodolite. The Observations are given in the usual form in the following tables.

PRECELLY.

Date.	R.O. 105° 33'.	Newton Down. 22° 44'.	Cunnagar. 34° 5'.	Croft. 38° 5'.	Bolton Hill. 39° 28'.	St. Thomas's Ch. Tr. 39° 30'.	St. Ann's. 44° 9'.	Plumstone Down. 64° 34'.	Lundy Island. 355° 17'.	x.
1865.	"			"				"		"
February 28	35.70							61.20		-0.40
March 1	32.94							63.95		-3.16
" "	35.57							61.32		-0.53
" "	36.34							60.54		+0.24
" "	36.19							60.69		+0.09
" "	34.78							62.11		-1.32
" "	36.74							60.15		+0.64
" "	36.75							60.13		+0.65
" "	36.70							60.18		+0.60
" "	36.42							60.46		+0.32
" 2	35.16			25.77						-0.94
" "	36.38			24.54						+0.28
" "	36.87			24.04						+0.77
" "	37.20			23.71						+1.10
" "	36.54			24.37						+0.44
" "	35.52			25.40						-0.58
" "	36.09			24.84						-0.01
" "	34.04			24.96				62.71		-2.06
" "	37.34			23.57						+1.24
" "	35.00			25.92						-1.10
" "	33.65			27.28						-2.45

PRECELLY—continued.

Date.	R.O.	Newton Down.	Cunnagar.	Croft.	Bolton Hill.	St. Thomas's Ch. Tr.	St. Ann's.	Plumstone Down.	Lundy Island.	x.
	105° 33'.	22° 44'.	34° 5'.	38° 5'.	39° 28'.	39° 30'.	44° 9'.	64° 34'.	355° 17'.	
1865.	"	"	"	"	"	"	"	"	"	"
March 2	35.83						11.25			-0.27
" "	35.50						11.58			-0.60
" 3	33.11			25.58				63.01		-2.99
" "	38.40			21.48				61.82		+2.30
" "	37.74			24.58				59.38		+1.64
" "	35.94			23.76				62.01		-0.16
" "	37.15		16.55							+1.05
" "	35.16		18.54							-0.94
" "	37.66		16.03							+1.56
" "	37.19		16.50							+1.09
" "	36.27		17.43							+0.17
" "	35.59		18.12							-0.51
" "	35.62		18.09							-0.48
" "	34.62		19.08							-1.48
" "	35.52		18.19							-0.58
" "	34.77		18.94							-1.33
" "	34.88		18.83							-1.22
" "	36.72		16.97							+0.62
" "	35.14		18.57							-0.96
" "	36.55		17.15							+0.45
" "	35.95		17.76							-0.15
" "	34.31								50.71	-1.79
" "	36.49							60.40		+0.39
" 6	37.30	44.47								+1.20
" "	35.36	46.41								-0.74
" "	35.76	46.01								-0.34
" "	36.61	45.16								+0.51
" "	35.50	46.28								-0.60
" "	36.55	45.22								+0.45
" "	33.96	47.81								-2.14
" "	36.62	45.15								+0.52
" "	35.18	46.60								-0.92
" "	35.64	46.14								-0.46
" "	34.86	46.91								-1.24
" "	37.05	45.72								+0.95
" "	37.13	44.63								+1.03
" "	35.43	46.35								-0.67
" "	35.06	46.72								-1.04
" "	34.56								50.47	-1.54
" "	35.09								49.94	-1.01
" "	36.46								48.55	+0.36
" "	36.12								48.90	+0.02
" "	35.97							61.38	48.47	-0.13
" "	36.32							60.57		+0.22
" 7	34.45				52.78			61.20		-1.65
" "	36.69				50.94					+0.59
" "	36.11				51.52					+0.01
" "	36.08				51.56					-0.02
" "	36.64				50.98					+0.54
" "	36.50				51.12					+0.40
" "	35.95				51.69					-0.15
" "	37.00				50.63					+0.90
" "	36.29				51.34					+0.19
" "	35.89				51.74					-0.21

PRECELLY—continued.

Date.	R.O.	Newton Down.	Cunnagar.	Croft.	Bolton Hill.	St. Thomas's Ch. Tr.	St. Ann's.	Plumstone Down.	Lundy Island.	x.
	105° 33'.	22° 44'.	34° 5'.	38° 5'.	39° 28'.	39° 30'.	44° 9'.	64° 34'.	355° 17'.	
1865:	"	"	"	"	"	"	"	"	"	"
March 7	36.02				51.61					-0.08
" "	35.78				51.86					-0.32
" "	35.34				52.29					-0.76
" "	36.35				51.28					+0.25
" "	35.52				52.11					-0.58
" "	36.76				50.86					+0.66
" "	37.06								47.95	+0.96
" "	37.48								47.54	+1.38
" "	36.68								48.33	+0.58
" "	36.00								49.03	-0.10
" 9	37.10					32.02				+1.00
" "	35.87					33.27				-0.23
" "	36.25					32.87				+0.15
" "	37.76					31.37				+1.66
" "	35.63					33.50				-0.47
" "	36.44					32.69				+0.34
" "	35.33					33.81				-0.77
" "	35.24					33.90				-0.86
" "	33.75					35.38				-2.35
" "	35.98					33.15				-0.12
" "	36.98					32.15				+0.88
" "	35.80					33.33				-0.30
" "	36.33					32.80				+0.23
" "	35.62					35.52				-0.48
" "	36.69					32.44				+0.59
" "	35.93								49.10	-0.17
" "	38.12								46.89	+2.02
" "	36.88								48.13	+0.78
" "	36.22								48.79	+0.12
" "	36.48					32.64				+0.38
" "	35.74					33.40				-0.36
" "	37.48					33.06				+1.38
" "	35.90						9.01	62.56	45.74	-0.20
" "	38.00						9.08	61.28	50.61	+1.90
" "	36.01						11.04		48.96	-0.09
" "	35.93							60.35	49.52	-0.17
" "	35.78							60.16	49.88	-0.32
" 11	37.60						9.47			+1.50
" 14	35.59						11.49			-0.51
" "	36.00						11.09			-0.10
" "	37.46						9.61			+1.36
" "	35.52						11.53	60.82		-0.58
" "	37.25							59.64		+1.15
" "	36.88	46.00						59.67		+0.78
" 17	37.68	45.14						59.74		+1.58
" "	36.51	45.66						60.39		+0.41
" "	37.70	45.47						59.39		+1.60
" 18	36.93		17.86					59.70		+0.83
" "	36.70		18.12					59.67		+0.60
" "	37.74		15.49					61.27		+1.64
" "	36.93		16.79							+0.83
" "	36.13		18.21					60.24		+0.03
" "	34.28							60.31	51.23	-1.82
" "	34.79						12.29			-1.31

PRECELLY—continued.

Date.	R.O.	Newton Down.	Cunnagar.	Croft.	Bolton Hill.	St. Thomas's Ch. Tr.	St. Ann's.	Plumstone Down.	Lundy Island.	x.
	105° 33'.	22° 44'.	34° 5'.	38° 5'.	39° 28'.	39° 30'.	44° 9'.	64° 34'.	355° 17'.	
1865:	"	"	"	"	"	"	"	"	"	"
March 18	36.22	43.49					13.05			+0.12
" 20	36.36						10.71			+0.26
" "	35.02						12.07			-1.08
" "	37.16						9.91			+1.06
" "	37.83						9.25			+1.73
" "	36.41						10.66			+0.31
" "	36.34						10.73			+0.24
" "	35.15						11.94			-0.95
" "	34.44						12.64			-1.66
" "	35.77						11.31			-0.33
" "	35.58						11.50			-0.52
" "	36.37						10.70			+0.27
" "	35.48						11.61			-0.62
Means	36.09	45.77	17.66	24.65	51.52	33.07	10.98	60.84	48.94	
No. of Obser- vations -	142	20	20	15	16	18	24	34	20	
Reciprocal of Weight -	0.0144	0.0903	0.0971	0.2196	0.0378	0.0794	0.0998	0.0698	0.1728	

CROFT.

Date.	Haylett Hill R. O.	Bolton Hill.	Priory Transit Pier N.	St. Thomas's Ch. Tr.	Plumstone Down.	Precelly.	Newton Down.	Cunnagar.	x.
	25° 26'.	44° 6'.	55° 6'.	82° 29'.	142° 28'.	217° 56'.	338° 38'.	342° 18'.	
1864:	"	"	"	"	"	"	"	"	"
November 18	44.74	21.99				33.57	37.57	49.04	-0.26
" "	42.89	22.85				33.54	38.07	49.59	-2.11
" "	45.12	20.42				32.92	38.64	49.81	+0.12
" 19	44.52	22.66		10.87	59.54				-0.48
" "	44.72	22.81		8.56	61.49				-0.28
" "	45.38	22.88		10.08			37.71		+0.38
" "	44.13	23.03					38.10		-0.87
" "	45.23	20.26						50.48	+0.23
" "	45.72			9.13	61.05				+0.72
" "	43.89				61.11			49.39	-1.11
" "	44.04			11.74					-0.96
" 21	46.87			8.17					+1.87
" "	45.52			9.66					+0.52
" 22	44.25	22.11		9.41			38.53	51.00	-0.75
" "	45.85	21.89		10.42	59.39	32.24	38.72		+0.85
" "	46.41	20.14			60.81	31.48	37.73	50.48	+1.41
" "	45.07	22.32		11.37	60.45	33.57	35.73		+0.07
" "	44.91	22.20			59.95	30.78	40.28	48.93	-0.09
" "	45.05	20.58			60.83	32.25	37.30	51.00	+0.05
" "	46.44	20.16			59.29	34.12	37.77	49.24	+1.44
" "	46.03	23.87			58.23	32.90	38.52	47.47	+1.03

CROFT—continued.

Date.	Haylett Hill R. O. 25° 26'.	Bolton Hill. 44° 6'.	Priory Transit Pier N. 55° 6'.	St. Thomas's Ch. Tr. 82° 29'.	Plumstone Down. 142° 28'.	Precelly, 217° 56'.	Newton Down. 338° 38'.	Cunnagar. 342° 18'.	x.
1864:	"	"	"	"	"	"	"	"	"
November 22	45.76	20.15			59.21	32.26	41.05	48.60	+0.76
" "	43.36	21.30		11.03	59.88	32.85		50.85	-1.64
" 23	45.31			10.43	60.40	33.10	39.25	47.63	+0.31
" "	44.87	22.76			60.54	32.22	37.62	49.01	-0.13
" "	45.20	21.82			61.04	30.84	40.04	48.07	+0.20
" "	44.26	20.26		11.85	62.70		37.33	49.03	-0.74
" "	46.00	21.50		12.42	57.75		38.50		+1.00
" "	46.35	20.95		9.86	60.61		38.95	48.70	+1.35
" "	45.40				60.06		39.15	48.33	+0.40
" "	43.61				61.78		39.59		-1.39
" "	43.03	22.96					39.53		-1.97
" "	45.13						39.05		+0.13
" 29	45.32		5.01			31.09			+0.32
" "	44.62		2.12			34.70			-0.38
" "	45.16		5.49			30.79			+0.16
" "	44.00		3.45	12.36					-1.00
" "	44.47		3.47	11.88					-0.53
" "	43.98		3.32	12.53					-1.02
" "	45.04		4.61	10.18					+0.04
" "	46.26	21.20	3.26						+1.26
" "	45.45		3.59						+0.45
" "	44.48		4.57						-0.52
" "	43.75		3.08	12.08			39.50		-1.25
Means	44.95	21.72	3.82	10.70	60.29	32.51	38.57	49.30	
No. of Observations	44	25	11	20	21	18	25	19	
Reciprocal of Weight	0.0388	0.0968	0.1604	0.1653	0.1207	0.1456	0.0990	0.1170	

PLUMSTONE DOWN.

Date.	R. O. 251° 45'.	St. Ann's. 24° 29'.	Precelly. 244° 27'.	Croft. 322° 30'.	Cunnagar. 325° 42'.	St. Thomas's Ch. Tr. 326° 36'.	Newton Down. 329° 52'.	Bolton Hill. 352° 34'.	x.
1864:	"	"	"	"	"	"	"	"	"
December 22	19.60				54.55				+0.20
" "	20.99			44.74					+1.59
" "	20.99			44.74					+1.59
" "	19.11			46.86	54.52				-0.29
" 23	20.80		53.30						+1.40
" "	19.05		55.07						-0.35
" "	17.31		56.81						-2.09
" "	18.72		55.38						-0.68
" "	17.72		56.39						-1.68
" "	18.53		55.58						-0.87
" "	20.23		54.23	47.03			1.48		+0.83
" "	19.49		54.61						+0.09

PLUMSTONE DOWN—continued.

Date.	R. O. 251° 45'.	St. Ann's. 24° 29'.	Precelly. 244° 27'.	Croft. 322° 30'.	Cunnagar. 325° 42'.	St. Thomas's Ch. Tr. 326° 36'.	Newton Down. 329° 52'.	Bolton Hill. 352° 34'.	x.
1864:	"	"	"	"	"	"	"	"	"
December 23	19.69		55.94	44.82					+0.29
" "	18.46		54.87	47.12					-0.94
" "	18.33		56.28				2.03		-1.07
" "	19.62		54.62	46.21					+0.22
" "	19.53		54.62	46.28					+0.13
" "	18.73		55.98	45.73					-0.67
" "	18.87		54.20	47.28	54.87				-0.53
" 24	21.68		52.43						+2.28
" "	19.24		51.40				5.99		-0.16
" "	17.85		53.10				5.69		-1.55
" "	18.93		51.85				5.85		-0.47
" "	18.34		54.74				3.55		-1.06
" "	19.88		54.79				1.96		+0.48
" "	19.41		55.94				1.28		+0.01
" "	20.38		55.13				1.13		+0.98
" "	17.78		55.55				3.30		-1.62
" "	18.21		54.54				3.88		-1.19
" "	19.11		54.83				2.69		-0.29
" "	20.05		52.35				4.25		+0.65
" "	18.48			48.68			1.09		-0.92
" "	20.03			48.12			0.12		+0.63
" 29	19.98			45.81	52.64	33.64		58.88	+0.58
" "	20.11			45.11	54.19	34.78			+0.71
" "	19.86			46.53	54.53	33.28			+0.46
" "	20.78				54.37	35.03		54.45	+1.38
" "	19.97				55.89	32.02			+0.57
" "	18.23			46.50	55.16	34.30			-1.17
" "	17.76			47.43	56.60	32.43			-1.64
" "	18.43			45.68	56.51	33.59			-0.97
" "	18.90			48.15	52.92	34.23			-0.50
" "	20.97				55.38	33.88	0.87	56.05	+1.57
" "	20.12				55.29	35.50	0.87	55.37	+0.72
" "	21.16				56.11	32.99	0.14		+1.76
" "	19.62			46.54	53.49	34.54			+0.22
" 30	18.77				55.82	33.45	1.15	57.98	-0.63
" "	19.50				55.79	33.29	2.62	55.95	+0.10
" "	19.35				55.39	33.14			-0.05
" "	19.80				54.01	34.05			+0.40
" "	19.01					34.11			-0.39
" 31	21.05					32.05			+1.65
" "	20.42		53.28			34.12			+1.02
" "	19.73			44.98		34.72			+0.33
" "	17.97			45.43		35.93		56.85	-1.43
" "	19.98					33.14		56.73	+0.58
" "	19.23					35.98		54.65	-0.17
" "	19.42			44.42		35.33		57.00	+0.02
" "	20.54		52.95	47.37		33.29			+1.14
1865:									
January 3	19.45	3.15						56.98	+0.05
" "	17.05	2.89						59.62	-2.35
" "	19.95	1.75						57.86	+0.55
" "	18.52	5.85						55.19	-0.88
" "	19.52	3.50					2.33		+0.12
" "	18.30	3.93					3.13		-1.10

PLUMSTONE DOWN—continued.

Date.	R. O. 251° 45'.	St. Ann's. 24° 29'.	Precelly. 244° 27'.	Croft. 322° 30'.	Cunnagar. 325° 42'.	St. Thomas's Ch. Tr. 326° 36'.	Newton Down. 329° 52'.	Bolton Hill. 352° 34'.	x.
1865:	"	"	"	"	"	"	"	"	"
January 3	21.83	0.99							+2.43
" "	18.62	4.21							-0.78
" "	17.96	4.87							-1.44
" "	19.77	3.52						56.27	+0.37
" "	18.73	2.52						58.27	-0.63
" "	20.77	3.44						55.35	+1.37
" "	19.03							57.12	-0.37
" "	19.62	3.20							+0.22
" "	18.76	3.26					2.76	57.31	-0.64
" "	19.62	2.20					1.65	58.62	+0.22
" "	19.30	1.63					2.21	58.96	-0.10
" "	20.82	3.73					0.57	56.98	+1.42
" "	19.67	3.17					4.00	55.25	+0.27
" "	18.62	5.50					2.37	55.62	-0.78
Means	19.39	3.33	54.51	46.31	54.90	33.95	2.46	56.80	
No. of Observations	79	19	29	24	20	26	28	24	
Reciprocal of Weight	0.0256	0.1544	0.1322	0.1143	0.1163	0.0861	0.1859	0.1655	

CUNNAGAR.

Date.	R.O. 161° 51'.	Bolton Hill. 81° 34'.	St. Thomas's Ch. Tr. 161° 50'.	Plumstone Down. 165° 42'.	Priory Transit Pier, N. 167° 31'.	Croft. 182° 19'.	Precelly. 233° 57'.	Newton Down. 357° 32'.	x.
1864:	"	"	"	"	"	"	"	"	"
December 14	4.73		43.81		62.06				+1.73
" "	4.33	0.83	49.26	6.83	58.83			37.16	+1.33
" "	4.25		47.50	3.17	62.34				+1.25
" "	2.89		45.48		62.31	45.24			-0.11
" "	3.91		44.83	7.50	60.16	46.16			+0.91
" "	1.96		46.34		61.79	45.79			-1.04
" "	4.72		45.72		62.22	43.22			+1.72
" "	2.11	6.61			62.02	43.69			-0.89
" "	4.40	3.56			61.53	44.95			+1.40
" "	3.84	1.37			63.95	45.29			+0.84
" "	3.61	2.77			62.94	45.11			+0.61
" 15	2.82		44.49			46.06			-0.18
" "	3.08				62.46				+0.08
" "	2.16				63.38				-0.84
" 16	3.09		45.37		61.62	45.81			+0.09
" "	2.65		44.60		61.10	47.54			-0.35
" "	3.16		44.62		64.26	43.84			+0.16
" "	3.01		43.38		64.21	45.29			+0.01

CUNNAGAR—continued.

Date.	R.O. 161° 51'.	Bolton Hill. 81° 34'.	St. Thomas's Ch. Tr. 161° 50'.	Plumstone Down. 165° 42'.	Priory Transit Pier, N. 167° 31'.	Croft. 182° 19'.	Precelly. 233° 57'.	Newton Down. 357° 32'.	x.
1864: December 16	2.50	"	"	"	"	"	"	"	"
" "	2.15		43.99		63.25	46.17			-0.50
" "	3.39				62.82	45.85			-0.85
" "	2.75				62.97	45.46			-0.61
" "	1.74	2.91		8.41	61.97	46.12			-0.25
" 17	3.10	2.35	44.64	7.10		44.02		36.57	-1.26
" "	3.61	2.94		8.56		44.69	24.31	38.77	+0.10
" "	2.57	6.15	44.55	4.03		46.73		35.31	+0.61
" "	1.66	4.44	44.99	6.79	64.82			35.98	-0.43
" "	2.67	2.87		6.53	64.33		24.23	34.56	-1.34
" "	3.13	6.29	46.29	5.38			22.51	36.03	-0.33
" "	2.74			8.12			23.29	35.59	+0.13
" "	2.94						25.71		-0.26
" "	2.80			7.13			24.22	35.23	-0.06
" "	3.59			5.72			24.84		-0.20
" "	3.35			7.53			23.25		+0.59
" "	0.86						26.25	36.78	+0.35
" "	2.15						27.49	36.78	-2.14
" "	2.90						23.25	34.24	-0.85
" "	2.61						25.06	37.74	-0.10
" "	2.80						24.71	36.23	-0.39
" "	1.17			7.84			25.14	36.38	-0.20
" "	4.14						23.51	36.23	-1.83
" "	3.26						25.59	36.23	+1.14
" "	3.09						25.92	35.04	+0.26
" "	2.68	4.18					24.26	34.89	+0.09
" "	2.49			8.66			22.99		-0.32
" "	2.93			8.95			22.25		-0.51
" "	3.52	5.36					22.22		-0.07
" 19	2.36		43.98		64.28				+0.52
" 20	3.41	2.27	45.99						-0.64
" "	2.96	3.61	45.12						+0.41
" "	4.29	2.81	45.93	5.29					-0.04
" "	4.17	4.08		5.00					+1.29
" "	2.40	5.10		5.76					+1.17
" "	1.55	4.18		7.52					-0.60
" "	3.53	3.36		6.36					-1.45
" "	3.66			6.43	62.61			35.86	+0.53
" "	1.85			4.15	63.77			38.80	+0.66
Means -	2.97	3.72	45.28	6.61	62.62	45.35	24.33	36.18	-1.15
No. of Ob- servations }	57	21	21	24	26	20	21	19	
Reciprocal of Weight }	0.0252	0.2189	0.1648	0.1930	0.1394	0.1090	0.1782	0.1609	

NEWTON DOWN.

Date.	Vane Steynton Ch. Tr. R.O. 85° 49'.	St. Ann's. 75° 14'.	Bolton Hill. 113° 5'.	Plumstone. Down. 149° 51'.	St. Thomas's Ch. Tr. 153° 31'.	Cunnagar. 157° 33'.	Croft. 158° 40'.	Precelly. 202° 37'.	x.
1864:	"	"	"	"	"	"	"	"	"
October 31	44.34		52.59			30.89	22.11		-1.36
" "	45.11		56.63			26.45	21.75		-0.59
" "	46.41		58.05			23.21	22.28		+0.71
November 2	44.99		58.05	60.14		22.47	24.49		-0.71
" "	45.51		56.09	60.81		23.51	24.18		-0.19
" "	45.56	32.93							-0.14
" "	46.06		57.11			24.89	21.89		+0.36
" "	44.98		57.76			23.89	23.31		-0.72
" "	46.49		57.16			24.43	21.86		+0.79
" "	46.97		54.56			25.11	23.31		+1.27
" "	45.87		55.85			24.52	23.72		+0.17
" "	44.99			60.90					-0.71
" "	46.50		55.22			24.38	23.83		+0.80
" "	45.29			60.59					-0.41
" "	45.50			60.38					-0.20
" "	44.60		56.22			25.97	23.15		-1.10
" 3	46.56					24.02			+0.86
" 7	46.69	31.79							+0.99
" "	46.43	32.05							+0.73
" "	44.70	33.79							-1.00
" "	45.06	33.43							-0.64
" "	46.91			61.26	11.69				+1.21
" "	44.31			59.97				40.56	-1.39
" 8	44.34				13.00			41.30	-1.36
" "	45.29				13.96			39.37	-0.41
" "	46.71				12.53			39.40	+1.01
" "	45.36				13.09			40.18	-0.34
" "	46.84				13.25			38.54	+1.14
" "	46.21				14.79			37.62	+0.51
" "	44.61	33.83		60.68	13.51				-1.09
" "	45.98	33.80		57.90	14.95				+0.28
" 9	46.90			59.54	13.40				+1.20
" "	46.00			59.37	14.48				+0.30
" "	45.03			60.23	16.06			37.48	-0.67
" "	44.00			57.92	15.79			41.09	-1.70
" "	43.89	32.51						41.06	-1.81
" "	47.13	32.50						37.83	+1.43
" "	47.65	31.32						38.48	+1.95
" "	45.86	34.41						37.19	+0.16
" "	45.12	32.36						39.96	-0.58
" "	46.99	32.10						38.35	+1.29
" "	45.54	33.21						38.71	-0.16
" "	46.54	33.46						37.46	+0.84
" "	46.40	33.73						37.32	+0.70
" "	45.68	33.13		58.68	15.15				-0.02
Means -	45.73	32.96	56.27	59.88	13.97	24.90	22.99	38.99	
No. of Ob- servations }	45	17	12	14	14	13	12	18	
Reciprocal of Weight }	0.0385	0.0817	0.3884	0.1528	0.2144	0.6224	0.1450	0.2098	

BOLTON HILL.

Date.		Vane Steynton Ch. Tr. R. O. 357° 24'.	St. Ann's. 53° 41'.	Plumstone Down. 172° 31'.	St. Thomas's Ch. Tr. 219° 11'.	Precelly. 219° 17'.	Croft. 224° 4'.	Cunnagar. 241° 31'.	Newton Down. 293° 2'.	x.
1864:		"	"	"	"	"	"	"	"	"
November	11	23.63			26.83		20.58	3.33		+0.63
"	"	21.74			28.69		19.21	4.74		-1.26
"	"	22.26			30.49		17.36			-0.74
"	"	24.46					15.96			+1.46
"	12	21.16	26.36							-1.84
"	"	22.28	25.24							-0.72
"	"	23.22	24.30							+0.22
"	"	22.59	24.93							-0.41
"	"	23.72	23.80							+0.72
"	"	23.77	23.11	0.52			20.61		10.61	+0.77
"	"	20.16		1.16			20.83	5.13	11.08	-2.84
"	14	23.17			29.85		17.10			+0.17
"	"	25.39						3.81	6.93	+2.39
"	"	25.00							6.88	+2.00
"	"	25.12		2.87	29.54			4.20		+2.12
"	"	23.10	23.68	5.52						+0.10
"	"	21.68	24.97	5.63						-1.32
"	"	21.76	24.48	6.93					8.01	-1.24
"	15	21.14		5.41	32.31	53.84				-1.86
"	"	24.22	23.14	4.31	30.31					+1.22
"	"	23.44					17.26	5.26	7.62	+0.44
"	"	23.68	23.68	4.93						+0.68
"	"	24.34			29.59		16.20			+1.34
"	"	22.18	23.68	6.43						-0.82
"	"	24.84			28.84		15.42	5.25		+1.84
"	"	21.79	25.34	5.43	29.43					-1.21
"	"	22.31					16.72	4.89	9.64	-0.69
"	"	22.78			30.54			3.63		-0.22
"	16	22.09				54.67			10.34	-0.91
"	"	21.98				55.86			9.26	-1.02
"	"	24.60				51.47			11.05	+1.60
"	"	22.69				55.56			8.87	-0.31
"	"	23.89				55.64			7.59	+0.89
"	"	23.65				53.20			10.25	+0.65
"	"	22.39				56.23	16.61	4.69		-0.61
"	"	23.29		3.71	30.91		16.96			+0.29
"	"	23.77	23.43					4.52	8.93	+0.77
"	"	22.82		5.19		54.99				-0.18
"	"	22.99		4.16		55.83				-0.01
"	"	22.07		3.68		56.18		5.32		-0.93
"	"	23.22		5.40		56.60	15.18			+0.22
"	"	23.36						1.99	10.79	+0.36
"	"	23.90				54.31				+0.90
"	"	22.82				57.15			7.14	-0.18
"	"	22.65			30.67	54.58				-0.35
"	"	22.25				55.97				-0.75
"	"	23.58				54.33	17.75			+0.58
"	"	23.38					17.04			+0.38
"	"	22.75						4.50		-0.25
Means		23.04	24.30	4.45	29.85	55.08	17.55	4.38	9.06	
No. of Observations		49	14	16	13	17	16	14	16	
Reciprocal of Weight		0.0490	0.1225	0.3608	0.2458	0.2167	0.3836	0.1146	0.2753	

ST. ANN'S.

Date.	R.O. 99° 38'.	Plumstone Down. 204° 25'.	Precelly. 223° 58'.	Bolton Hill. 233° 41'.	Newton Down. 255° 10'.	Lundy Island. 329° 26'.	x.
1865:	"	"	"	"	"	"	"
January 21	54.33			27.10			-0.17
" "	56.20			25.22			+0.70
" "	56.22			25.20			+0.72
" "	55.48			25.95			-0.02
" "	54.47			27.14	44.89		-1.03
" 27	55.63			25.80			+0.13
" "	56.81	10.39		25.72			+1.31
" "	56.08	10.91		25.95			+0.58
" "	54.20	9.62		29.12			-1.30
" "	54.81	12.39		27.51	43.31		-0.69
" "	56.52	8.27		24.61	48.61		+1.02
" "	54.97			26.85	44.69		-0.53
" "	54.69			27.86	43.96		-0.81
" 28	58.44	10.52	12.61				+2.94
" "	56.80	10.20					+1.30
" "	57.19					47.28	+1.69
" "	55.02					49.45	-0.48
" "	54.92		16.89			47.20	-0.58
" "	54.04		16.04				-1.46
" "	56.09			25.34			+0.59
" "	57.00			24.42			+1.50
February 3	54.84			26.59			-0.66
" "	55.91				44.66		+0.41
" "	56.70				43.87		+1.20
" 9	54.71				45.87		-0.79
" "	55.64			24.23	46.63		+0.14
" "	53.92			27.09	45.51		-1.58
" "	55.85			25.32	45.35		+0.35
" "	54.84	11.17		25.84	46.17		-0.66
" "	56.77	10.17		25.73	45.32		+1.27
" 10	52.94					51.53	-2.56
" "	53.97					50.50	-1.53
" "	55.49					48.99	-0.01
" "	56.61					47.86	+1.11
" "	56.71	10.23		25.65	45.40		+1.21
" "	53.38	13.63					-2.12
" "	54.24	12.77					-1.26
" "	54.69	12.32					-0.81
" "	54.22	14.34		24.36			-1.28
" "	54.54			26.82	45.16		-0.96
" "	53.46	13.54					-2.04
" "	56.36				45.44	47.74	+0.86
" 13	54.07	12.94					-1.43
" 17	56.31	12.40		24.73	44.56		+0.81
" "	54.77	12.53		25.62	42.70		-0.73
" "	56.60	12.52	16.95	24.44	44.44		+1.10
" "	56.49	10.57					+0.99
" "	55.22	12.14	14.22				-0.28
" "	53.43		15.68			49.91	-2.07
" "	56.07				44.95	48.53	+0.57
" "	56.24				44.24	49.08	+0.74
" "	54.28					50.20	-1.22
" "	57.29	8.84			45.96		+1.79
" "	57.25					47.21	+1.75

ST. ANN'S—continued.

Date.	R.O. 99° 38'.	Plumstone Down. 204° 25'.	Precelly. 223° 58'.	Bolton Hill. 233° 41'.	Newton Down. 255° 10'.	Lundy Island. 329° 26'.	x.
1865: February 17	" 56.77	" 10.68	" 16.97	" 12.41	" 46.04	" 47.69	" +1.27
" "	56.10					49.18	+0.60
" "	53.88					49.63	-1.62
" "	53.10		16.97				-2.40
" 20	57.65		12.41				+2.15
" "	55.25		14.83				-0.25
" "	57.97		12.09				+2.47
" "	56.12		13.95				+0.62
" "	54.00		16.08				-1.50
" "	56.03		14.03				+0.53
" "	57.05		13.01				+1.55
" "	53.83		16.24				-1.67
" "	56.70		13.36				+1.20
" "	56.97		13.10				+1.47
" "	58.14		11.92				+2.64
" "	55.30		14.76				-0.20
" "	57.03		13.03				+1.53
" "	55.20		14.87				-0.30
" "	54.32		15.74				-1.18
" "	55.83		14.25				+0.33
" "	53.31		16.77				-2.19
" "	55.25		14.83				-0.25
" "	57.14		12.92				+1.64
" "	55.90	11.84			44.34		+0.40
" "	55.27	13.11			43.69		-0.23
" "	53.65	11.65			46.78		-1.85
" "	54.73		15.35				-0.77
" "	53.42		16.65				-2.08
" "	55.69		14.37				+0.19
Means	55.49	11.52	14.62	25.93	45.10	48.87	
No. of Observations	83	26	29	27	26	16	
Reciprocal of Weight	0.0405	0.1724	0.1673	0.1035	0.1111	0.1994	

PRIORY TRANSIT PIER N.

Date.	Cunnagar R.O. 327° 32'.	St. Thomas's Church Tower 115° 40'.	Croft. 235° 7'.	x.
1864: December 12	" 7.62	" 42.40	" 1.40	" +1.82
" "	4.03	43.53	3.86	-1.77
" "	5.61	42.78	3.03	-0.19
" "	5.89	43.70	1.84	+0.09
" "	4.96	43.53	2.93	-0.84
" "	5.84	43.13	2.46	+0.04
" "	6.07	43.11	2.24	+0.27
" "	5.87	43.78	1.78	+0.07

PRIORY TRANSIT PIER N.—*continued.*

Date.	Cunnagar R.O. 327° 32'.	St. Thomas's Church Tower 115° 40'.	Croft. 235° 7'.	x.
1864: December 12	" 6.47	" 43.06	" 1.89	" +0.67
" "	4.35	44.90	2.18	-1.45
" "	6.46	43.29	1.67	+0.66
" "	6.18	43.48	1.76	+0.38
" "	6.23	43.90	1.31	+0.43
" "	5.59	45.26	0.59	-0.21
Means	5.80	43.56	2.07	
No. of Observations	14	14	14	
Reciprocal of Weight	0.1085	0.0770	0.0888	

ST. THOMAS'S CH. TOWER.

Date.	R. O. 9° 31'.	Bolton Hill. 39° 15'.	Plumstone Down. 146° 36'.	Precelly. 219° 23'.	Croft. 262° 31'.	Priory Transit Pier, N. 295° 41'.	Cunnagar. 321° 51'.	Newton Down. 333° 31'.	x.
1864: December 6	"	"	"	"	"	"	"	"	"
" "	53.02	26.88	39.80			36.55		18.18	+2.82
" "	52.26	24.39	40.29			37.89		19.61	+2.06
" "	50.52	25.49	39.12			40.39		18.91	+0.32
" "	50.30	26.80	39.44			39.00		18.89	+0.10
" "	49.41	23.95		32.78		40.53		20.66	-0.79
" "	50.54	24.37		35.04		36.04		21.36	+0.34
" "	49.91	25.19				37.69		21.03	-0.29
" "	50.28			30.20		41.28			+0.08
" "	51.53	24.98		32.13	3.40			20.23	+1.33
" "	49.64			32.06	5.01				-0.56
" "	49.98			32.98	3.73				-0.22
" "	50.75			33.85	2.10				+0.55
" "	49.73			34.32	2.65				-0.47
" "	49.51			34.34	2.84				-0.69
" "	50.76			32.46				21.09	+0.56
" "	49.79			33.95					-0.41
" "	49.65			34.25				20.42	-0.55
" "	50.04	24.08			1.54		44.43	20.29	-0.16
" "	51.63	24.85	39.72		5.05		40.13	19.65	+1.43
" "	50.51	23.06			3.31	37.47	42.06	21.97	+0.31
" 8	50.14	24.56		34.06					-0.06
" "	50.34			34.41				19.57	+0.14
" "	48.49	25.77			2.90	40.99	42.24	18.04	-1.71
" "	50.40	26.08			0.25			22.00	+0.20
" "	49.69	23.56			2.98	39.98			-0.51
" "	50.39	25.73			4.73	34.61		21.31	+0.19
" "	51.42		39.55		4.38	36.47			+1.22
" "	47.40		41.06		2.40		43.98	21.15	-2.80
" "	52.14	25.89	41.19	32.31	1.37		41.06		+1.94
" "	50.56		40.65	33.15					+0.36
" "	51.16		39.61	33.61					+0.96

ST. THOMAS'S CH. TOWER.—*continued.*

Date.	R. O. 9° 31'.	Bolton Hill. 39° 15'.	Plumstone Down. 146° 36'.	Precelly. 219° 23'.	Croft. 262° 31'.	Priory Transit Pier, N. 295° 41'.	Cunnagar. 321° 51'.	Newton Down. 333° 31'.	<i>x.</i>
1864:	"	"	"	"	"	"	"	"	"
December 8	48.87			36.12			40.40		-1.33
" "	48.54			34.88			41.96		-1.66
" "	49.87		39.84	34.67					-0.33
" 9	50.12	26.15					40.60		-0.08
" "	50.40		41.82	32.15					+0.20
" "	49.37				4.29		39.95	21.79	-0.83
" "	49.67		42.57			36.01	42.26		-0.53
" "	49.76		41.90		2.28	38.11	41.43		-0.44
" "	50.54		39.16				42.79		+0.34
" "	49.52		43.39				40.94	19.19	-0.68
" "	49.31		40.47				40.39	22.89	-0.89
" "	50.89				0.50		41.42	22.57	+0.69
" "	50.56		42.26				39.65		+0.36
" "	50.05		44.35			37.22	38.89		-0.15
" "	50.89	26.12	42.59				37.55	20.90	+0.69
" "	47.64	26.24	41.22				41.52	21.44	-2.56
" "	50.51	25.81	38.51					21.56	+0.31
" "	49.96	25.88	40.38					20.20	-0.24
" "	49.37					38.37	42.12		-0.83
Means	50.15	25.26	40.82	33.51	2.93	38.15	41.23	20.57	
No. of Obser- vations - }	50	22	23	21	9	17	21	26	
Reciprocal of Weight - }	0.0418	0.0947	0.1877	0.1633	0.1992	0.4237	0.2302	0.1226	

Proceeding now to the reduction of these angles, we shall name the stations by the following letters—

Precelly	A	Croft	D	St. Ann's Hill	H
Bolton Hill	B	St. Thomas' Ch.	E	Plumstone Down	I
Cunnagar.....	C	Lundy Island	F	Priory Transit Pier	J
		Newton Down	G		

The equations of condition are thirty-five in number, as follows:—

- I. $EDJ + DEJ + EJD = 180^\circ + \epsilon_1$
- II. $DCE + CDE + CED = 180^\circ + \epsilon_2$
- III. $DCJ + CDJ + CJD = 180^\circ + \epsilon_3$
- IV. $CBD + BCD + BDC = 180^\circ + \epsilon_4$
- V. $CBE + BCE + BEC = 180^\circ + \epsilon_5$
- VI. $BGE + GBE + BEG = 180^\circ + \epsilon_6$
- VII. $BGD + GBD + BDG = 180^\circ + \epsilon_7$
- VIII. $BGC + GBC + BCG = 180^\circ + \epsilon_8$
- IX. $GBH + BGH + BHG = 180^\circ + \epsilon_9$

- x. $HIG + IHG + IGH = 180^\circ + \varepsilon_{10}$
 xi. $BIH + IHB + HBI = 180^\circ + \varepsilon_{11}$
 xii. $BIC + IBC + BCI = 180^\circ + \varepsilon_{12}$
 xiii. $BID + IBD + BDI = 180^\circ + \varepsilon_{13}$
 xiv. $BIE + IBE + BEI = 180^\circ + \varepsilon_{14}$
 xv. $HAI + AIH + AHI = 180^\circ + \varepsilon_{15}$
 xvi. $BAI + AIB + ABI = 180^\circ + \varepsilon_{16}$
 xvii. $CAI + AIC + ACI = 180^\circ + \varepsilon_{17}$
 xviii. $DAI + AID + ADI = 180^\circ + \varepsilon_{18}$
 xix. $EAI + AIE + AEI = 180^\circ + \varepsilon_{19}$
 xx. $GAI + AIG + AGI = 180^\circ + \varepsilon_{20}$
 xxi. $HAF + AFH + AHF = 180^\circ + \varepsilon_{21}$
 xxii. $\frac{\sin DEC \sin DJE \sin DCJ}{\sin DCE \sin DEJ \sin DJC} = 1$
 xxiii. $\frac{\sin DEC \sin DBE \sin DCB}{\sin DCE \sin DEB \sin DBC} = 1$
 xxiv. $\frac{\sin DBE \sin DGB \sin DEG}{\sin DEB \sin DBG \sin DGE} = 1$
 xxv. $\frac{\sin CBE \sin CGB \sin CEG}{\sin CEB \sin CBG \sin CGE} = 1$
 xxvi. $\frac{\sin BGI \sin BHG \sin BIH}{\sin BIG \sin BGH \sin BHI} = 1$
 xxvii. $\frac{\sin BCI \sin BGC \sin BIG}{\sin BIC \sin BCG \sin BGI} = 1$
 xxviii. $\frac{\sin BDI \sin BGD \sin BIG}{\sin BID \sin BDG \sin BGI} = 1$
 xxix. $\frac{\sin BEI \sin BGE \sin BIG}{\sin BIE \sin BEG \sin BGI} = 1$
 xxx. $\frac{\sin HIA \sin HGI \sin HAG}{\sin HAI \sin HIG \sin HGA} = 1$
 xxxi. $\frac{\sin IBA \sin IGB \sin IAG}{\sin IAB \sin IBG \sin IGA} = 1$
 xxxii. $\frac{\sin IBA \sin ICB \sin IAC}{\sin IAB \sin IBC \sin ICA} = 1$
 xxxiii. $\frac{\sin IBA \sin IDB \sin IAD}{\sin IAB \sin IBD \sin IDA} = 1$
 xxxiv. $\frac{\sin IBA \sin IEB \sin IAE}{\sin IAB \sin IBE \sin IEA} = 1$
 xxxv. $\frac{\sin GFA \sin GHF \sin GAH}{\sin GAF \sin GFH \sin GHA} = 1$

In forming the numerical equations from these, we suppose as usual, that the observed bearings have corrections (1) (2).... attached. For convenience we bring together the bearings in the following Table:—

Stations.	Bearings.	$\frac{1}{w}$	Stations.	Bearings.	$\frac{1}{w}$
<i>At Priory Transit Pier.</i>			<i>At Bolton Hill.</i>		
St. Thomas' Ch. Tr.	115 40 43.56 + (1)	0.077	St. Ann's Hill.....	53 41 24.30 + (32)	0.122
Croft	235 7 2.07 + (2)	0.089	Plumstone Down...	172 31 4.45 + (33)	0.361
Cunnagar.....	327 32 5.80 + (3)	0.108	St. Thomas' Ch. Tr..	219 11 29.85 + (34)	0.246
<i>At Croft.</i>			Precelly	219 17 55.08 + (35)	0.217
Bolton Hill	44 6 21.72 + (4)	0.097	Croft	224 4 17.55 + (36)	0.384
Priory Transit Pier	55 6 3.82 + (5)	0.160	Cunnagar.....	241 31 4.38 + (37)	0.115
St. Thomas' Ch. Tr.	82 29 10.70 + (6)	0.165	Newton Down ...	293 2 9.06 + (38)	0.275
Plumstone Down...	142 29 0.29 + (7)	0.121	<i>At Plumstone Down.</i>		
Precelly	217 56 32.51 + (8)	0.146	St. Ann's Hill.....	24 29 3.33 + (39)	0.154
Newton Down ...	338 38 38.57 + (9)	0.099	Precelly	244 27 54.51 + (40)	0.132
Cunnagar.....	342 18 49.30 + (10)	0.117	Croft	322 30 46.31 + (41)	0.114
<i>At Cunnagar.</i>			Cunnagar.....	325 42 54.90 + (42)	0.116
Bolton Hill	81 34 3.72 + (11)	0.219	St. Thomas' Ch. Tr..	326 36 33.95 + (43)	0.086
St. Thomas' Ch. Tr.	161 50 45.28 + (12)	0.165	Newton Down ...	329 52 2.46 + (44)	0.186
Plumstone Down...	165 42 6.61 + (13)	0.193	Bolton Hill	352 34 56.80 + (45)	0.165
Priory Transit Pier	167 32 2.62 + (14)	0.139	<i>At St. Ann's Hill.</i>		
Croft	182 19 45.35 + (15)	0.109	Plumstone Down...	204 25 11.52 + (46)	0.172
Precelly	233 57 24.33 + (16)	0.178	Precelly	223 58 14.62 + (47)	0.167
Newton Down ...	357 32 36.18 + (17)	0.161	Bolton Hill	233 41 25.93 + (48)	0.103
<i>At St. Thomas' Ch. Tr.</i>			Newton Down ...	255 10 45.10 + (49)	0.111
Bolton Hill	39 15 25.26 + (18)	0.095	Lundy Island	329 26 48.87 + (50)	0.199
Plumstone Down...	146 36 40.82 + (19)	0.188	<i>At Precelly.</i>		
Precelly	219 23 33.51 + (20)	0.163	Newton Down ...	22 44 45.77 + (51)	0.090
Croft	262 31 2.93 + (21)	0.199	Cunnagar.....	34 5 17.66 + (52)	0.097
Priory Transit Pier	295 41 38.15 + (22)	0.424	Croft	38 5 24.65 + (53)	0.220
Cunnagar.....	321 51 41.23 + (23)	0.230	Bolton Hill	39 28 51.52 + (54)	0.038
Newton Down ...	333 31 20.57 + (24)	0.123	St. Thomas' Ch. Tr..	39 30 33.07 + (55)	0.079
<i>At Newton Down.</i>			St. Ann's Hill	44 9 10.98 + (56)	0.100
St. Ann's Hill.....	75 14 32.96 + (25)	0.082	Plumstone Down...	64 35 0.84 + (57)	0.070
Bolton Hill	113 5 56.27 + (26)	0.388	Lundy Island	355 17 48.94 + (58)	0.173
Plumstone Down...	149 51 59.88 + (27)	0.153	<i>At Lundy Island.</i>		
St. Thomas' Ch. Tr.	153 31 13.97 + (28)	0.214	St. Ann's Hill.....	149 42 30.58 + (59)	0.158
Cunnagar.....	157 33 24.90 + (29)	0.622	Newton Down.....	165 1 46.99 + (60)	0.164
Croft	158 40 22.99 + (30)	0.145	Precelly	175 22 41.09 + (61)	0.177
Precelly	202 37 38.99 + (31)	0.210			

The substitution of these bearings in the geometrical equations of condition, gives the following numerical results:—

- I. $0 = +0.610 - (1) + (2) - (5) + (6) - (21) + (22)$
- II. $0 = -0.233 + (6) - (10) - (12) + (15) - (21) + (23)$
- III. $0 = +0.978 - (2) + (3) + (5) - (10) - (14) + (15)$
- IV. $0 = +0.856 + (4) - (10) - (11) + (15) - (36) + (37)$

- V. $0 = +0.092 - (11) + (12) + (18) - (23) - (34) + (37)$
 VI. $0 = +1.499 + (18) - (24) - (26) + (28) - (34) + (38)$
 VII. $0 = +1.272 + (4) - (9) - (26) + (30) - (36) + (38)$
 VIII. $0 = +0.769 + (11) - (17) - (26) + (29) - (37) + (38)$
 IX. $0 = -2.493 - (25) + (26) + (32) - (38) - (48) + (49)$
 X. $0 = +0.623 - (25) + (27) + (39) - (44) - (46) + (49)$
 XI. $0 = +0.753 - (32) + (33) + (39) - (45) - (46) + (48)$
 XII. $0 = +4.569 - (11) + (13) - (33) + (37) - (42) + (45)$
 XIII. $0 = +2.019 - (4) + (7) - (33) + (36) - (41) + (45)$
 XIV. $0 = +3.692 - (18) + (19) - (33) + (34) - (43) + (45)$
 XV. $0 = +1.077 + (39) - (40) - (46) + (47) - (56) + (57)$
 XVI. $0 = +1.660 - (33) + (35) - (40) + (45) - (54) + (57)$
 XVII. $0 = +0.724 - (13) + (16) - (40) + (42) - (52) + (57)$
 XVIII. $0 = -0.263 - (7) + (8) - (40) + (41) - (53) + (57)$
 XIX. $0 = -0.561 - (19) + (20) - (40) + (43) - (55) + (57)$
 XX. $0 = +1.254 - (27) + (31) - (40) + (44) - (51) + (57)$
 XXI. $0 = +0.321 - (47) + (50) + (56) - (58) - (59) + (61)$
 XXII. $0 = -193.424 + 11.883 (1) - 12.772 (2) + 0.889 (3)$
 $+ 56.365 (12) - 79.718 (14) + 23.353 (15)$
 $+ 19.725 (21) - 32.205 (22) + 12.480 (23)$
 XXIII. $0 = -481.214 + 4.002 (11) + 56.365 (12) - 60.367 (15)$
 $+ 22.374 (18) - 34.854 (21) + 12.480 (23)$
 $- 246.614 (34) + 313.611 (36) - 66.997 (37)$
 XXIV. $0 = -83.372 + 22.374 (18) - 29.622 (21) + 7.248 (24)$
 $- 20.637 (26) + 233.502 (28) - 212.865 (30)$
 $- 246.614 (34) + 254.711 (36) - 8.097 (38)$
 XXV. $0 = +250.815 - 4.708 (18) - 97.314 (23) + 102.022 (24)$
 $- 21.457 (36) + 298.381 (28) - 276.924 (29)$
 $- 51.271 (34) + 68.008 (37) - 16.737 (38)$
 XXVI. $0 = +367.859 + 27.089 (25) - 55.267 (26) + 28.178 (27)$
 $+ 33.824 (39) + 50.297 (44) - 84.121 (45)$
 $+ 37.565 (46) - 91.048 (48) + 53.483 (49)$
 XXVII. $0 = -30.286 - 4.367 (11) + 2.163 (13) + 2.204 (17)$
 $+ 6.721 (26) - 28.178 (27) + 21.457 (29)$
 $+ 41.561 (42) - 50.297 (44) + 8.736 (45)$
 XXVIII. $0 = -5.199 - 6.511 (4) - 3.101 (7) + 9.612 (9)$
 $+ 7.541 (26) - 21.178 (27) + 20.637 (30)$
 $+ 36.367 (41) - 50.297 (44) + 13.930 (45)$
 XXIX. $0 = +11.148 - 2.911 (18) - 6.580 (19) + 9.491 (24)$
 $+ 3.457 (26) - 28.178 (27) + 24.721 (28)$
 $+ 43.221 (43) - 50.297 (44) + 7.076 (45)$
 XXX. $0 = -180.874 - 21.879 (25) + 5.790 (27) + 16.089 (31)$
 $- 40.064 (39) + 25.110 (40) + 14.954 (44)$
 $- 53.707 (51) + 110.230 (56) - 56.523 (57)$
 XXXI. $0 = -19.875 - 28.178 (26) + 44.182 (27) - 16.004 (31)$
 $- 32.196 (33) + 19.785 (35) + 12.411 (38)$
 $- 23.518 (51) + 44.943 (54) - 21.425 (57)$

$$\begin{aligned}
\text{xxxii. } 0 &= - 48.125 - 2.163 (11) + 10.561 (13) - 8.398 (16) \\
&\quad - 11.703 (33) + 19.785 (35) - 8.082 (37) \\
&\quad - 35.751 (52) + 44.943 (54) - 9.192 (57) \\
\text{xxxiii. } 0 &= - 7.776 + 3.101 (4) + 2.360 (7) - 5.461 (8) \\
&\quad - 3.069 (33) + 19.785 (35) - 16.716 (36) \\
&\quad - 42.242 (53) + 44.943 (54) - 2.701 (57) \\
\text{xxxiv. } 0 &= - 129.898 + 6.580 (18) - 0.055 (19) - 6.525 (20) \\
&\quad + 0.075 (33) - 19.860 (34) + 19.785 (35) \\
&\quad + 44.943 (54) - 45.000 (55) + 0.057 (57) \\
\text{xxxv. } 0 &= - 197.689 + 34.755 (47) - 40.686 (49) + 5.931 (50) \\
&\quad - 94.241 (51) + 53.707 (56) + 40.534 (58) \\
&\quad + 76.853 (59) - 192.159 (60) + 115.306 (61)
\end{aligned}$$

Proceeding in the ordinary manner, we next arrive at the following equations:—

$$\begin{aligned}
(1) \div 0.077 &= - I + 11.883 \text{ xxii} \\
(2) \div 0.089 &= + I - \text{iii} - 12.772 \text{ xxii} \\
(3) \div 0.108 &= + \text{iii} + 0.889 \text{ xxii} \\
(4) \div 0.097 &= + \text{iv} + \text{vii} - \text{xiii} - 6.511 \text{ xxviii} + 3.101 \text{ xxxiii} \\
(5) \div 0.160 &= - I + \text{iii} \\
(6) \div 0.165 &= + I + \text{ii} \\
(7) \div 0.121 &= + \text{xiii} - \text{xviii} - 3.101 \text{ xxviii} + 2.360 \text{ xxxiii} \\
(8) \div 0.146 &= + \text{xviii} - 5.461 \text{ xxxiii} \\
(9) \div 0.099 &= - \text{vii} + 9.612 \text{ xxviii} \\
(10) \div 0.117 &= - \text{ii} - \text{iii} - \text{iv} \\
(11) \div 0.219 &= - \text{iv} - \text{v} + \text{viii} - \text{xii} + 4.002 \text{ xxiii} - 4.367 \text{ xxvii} - 2.163 \text{ xxxii} \\
(12) \div 0.165 &= - \text{ii} + \text{v} + 56.365 \text{ xxii} + 56.365 \text{ xxiii} \\
(13) \div 0.193 &= + \text{xii} - \text{xvii} + 2.163 \text{ xxvii} + 10.561 \text{ xxxii} \\
(14) \div 0.139 &= - \text{iii} - 79.718 \text{ xxii} \\
(15) \div 0.109 &= + \text{ii} + \text{iii} + \text{iv} + 23.353 \text{ xxii} - 60.367 \text{ xxiii} \\
(16) \div 0.178 &= + \text{xvii} - 8.398 \text{ xxxii} \\
(17) \div 0.161 &= - \text{viii} + 2.204 \text{ xxvii} \\
(18) \div 0.095 &= + \text{v} + \text{vi} - \text{xiv} + 22.374 \text{ xxiii} + 22.374 \text{ xxiv} - 4.708 \text{ xxv} - 2.911 \\
&\quad \text{xxix} + 6.580 \text{ xxxiv} \\
(19) \div 0.188 &= + \text{xiv} - \text{xix} - 6.580 \text{ xxix} - 0.055 \text{ xxxiv} \\
(20) \div 0.163 &= + \text{xix} - 6.525 \text{ xxxiv} \\
(21) \div 0.199 &= - I - \text{ii} + 19.725 \text{ xxii} - 34.854 \text{ xxiii} - 29.622 \text{ xxiv} \\
(22) \div 0.424 &= + I - 32.205 \text{ xxii} \\
(23) \div 0.230 &= + \text{ii} - \text{v} + 12.480 \text{ xxii} + 12.480 \text{ xxiii} - 97.314 \text{ xxv} \\
(24) \div 0.124 &= - \text{vi} + 7.248 \text{ xxiv} + 102.022 \text{ xxv} + 9.491 \text{ xxix} \\
(25) \div 0.082 &= - \text{ix} - \text{x} + 27.089 \text{ xxvi} - 21.879 \text{ xxx} \\
(26) \div 0.388 &= - \text{vi} - \text{vii} - \text{viii} + \text{ix} - 20.637 \text{ xxiv} - 21.457 \text{ xxv} - 55.267 \text{ xxvi} + \\
&\quad 6.721 \text{ xxvii} + 7.541 \text{ xxviii} + 3.457 \text{ xxix} - 28.178 \text{ xxxi} \\
(27) \div 0.153 &= + \text{x} - \text{xx} + 28.178 \text{ xxvi} - 28.178 \text{ xxvii} - 28.178 \text{ xxviii} - 28.178 \\
&\quad \text{xxix} + 5.790 \text{ xxx} + 44.182 \text{ xxxi} \\
(28) \div 0.214 &= + \text{vi} + 233.502 \text{ xxiv} + 298.381 \text{ xxv} + 24.721 \text{ xxix} \\
(29) \div 0.622 &= + \text{viii} - 276.924 \text{ xxv} + 21.457 \text{ xxvii} \\
(30) \div 0.145 &= + \text{vii} - 212.865 \text{ xxiv} + 20.637 \text{ xxviii}
\end{aligned}$$

- (31) $\div 0.210 = + XX + 16.089 \text{ XXX} - 16.004 \text{ XXXI}$
- (32) $\div 0.122 = + IX - XI$
- (33) $\div 0.361 = + XI - XII - XIII - XIV - XVI - 32.196 \text{ XXXI} - 11.703 \text{ XXXII} - 3.069 \text{ XXXIII} + 0.075 \text{ XXXIV}$
- (34) $\div 0.246 = - V - VI + XIV - 246.614 \text{ XXIII} - 246.614 \text{ XXIV} - 51.271 \text{ XXV} - 19.860 \text{ XXXIV}$
- (35) $\div 0.217 = + XVI + 19.785 \text{ XXXI} + 19.785 \text{ XXXII} + 19.785 \text{ XXXIII} + 19.785 \text{ XXXIV}$
- (36) $\div 0.384 = - IV - VII + XIII + 313.611 \text{ XXIII} + 254.711 \text{ XXIV} - 16.716 \text{ XXXIII}$
- (37) $\div 0.115 = + IV + V - VIII + XII - 66.997 \text{ XXIII} + 68.008 \text{ XXV} - 8.082 \text{ XXXII}$
- (38) $\div 0.275 = + VI + VII + VIII - IX - 8.097 \text{ XXIV} - 16.737 \text{ XXV} + 12.411 \text{ XXXI}$
- (39) $\div 0.154 = + X + XI + XV + 33.824 \text{ XXVI} - 40.064 \text{ XXX}$
- (40) $\div 0.132 = - XV - XVI - XVII - XVIII - XIX - XX + 25.110 \text{ XXX}$
- (41) $\div 0.114 = - XIII + XVIII + 36.367 \text{ XXVIII}$
- (42) $\div 0.116 = - XII + XVII + 41.561 \text{ XXVII}$
- (43) $\div 0.086 = - XIV + XIX + 43.221 \text{ XXIX}$
- (44) $\div 0.186 = - X + XX + 50.297 \text{ XXVI} - 50.297 \text{ XXVII} - 50.297 \text{ XXVIII} - 50.297 \text{ XXIX} + 14.954 \text{ XXX}$
- (45) $\div 0.165 = - XI + XII + XIII + XIV + XVI - 84.121 \text{ XXVI} + 8.736 \text{ XXVII} + 13.930 \text{ XXVIII} + 7.076 \text{ XXIX}$
- (46) $\div 0.172 = - X - XI - XV + 37.565 \text{ XXVI}$
- (47) $\div 0.167 = + XV - XXI + 34.755 \text{ XXXV}$
- (48) $\div 0.103 = - IX + XI - 91.048 \text{ XXVI}$
- (49) $\div 0.111 = + IX + X + 53.483 \text{ XXVI} - 40.686 \text{ XXXV}$
- (50) $\div 0.199 = + XXI + 5.931 \text{ XXXV}$
- (51) $\div 0.090 = - XX - 53.707 \text{ XXX} - 23.518 \text{ XXXI} - 94.241 \text{ XXXV}$
- (52) $\div 0.097 = - XVII - 35.751 \text{ XXXII}$
- (53) $\div 0.220 = - XVIII - 42.242 \text{ XXXIII}$
- (54) $\div 0.038 = - XVI + 44.943 \text{ XXXI} + 44.943 \text{ XXXII} + 44.943 \text{ XXXIII} + 44.943 \text{ XXXIV}$
- (55) $\div 0.079 = - XIX - 45.000 \text{ XXXIV}$
- (56) $\div 0.100 = - XV + XXI + 110.230 \text{ XXX} + 53.707 \text{ XXXV}$
- (57) $\div 0.070 = + XV + XVI + XVII + XVIII + XIX + XX - 56.523 \text{ XXX} - 21.425 \text{ XXXI} - 9.192 \text{ XXXII} - 2.701 \text{ XXXIII} + 0.057 \text{ XXXIV}$
- (58) $\div 0.173 = - XXI + 40.534 \text{ XXXV}$
- (59) $\div 0.158 = - XXI + 76.853 \text{ XXXV}$
- (60) $\div 0.164 = - 192.159 \text{ XXXV}$
- (61) $\div 0.177 = + XXI + 115.306 \text{ XXXV}$

From these we have to determine (1) (2) (3).....(61) in terms of I. II. III.....XXXV, and substitute the results in the equations of condition. The resulting equations are tabulated as follows:

Absolute Term.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
0=+ 0.610	+ 1.114	+ 0.364	- 0.249						
0=- 0.233	+ 0.249	+ 0.985	+ 0.226	+ 0.226	- 0.395				
0=+ 0.978		+ 0.226	+ 0.722	+ 0.226					
0=+ 0.856		+ 0.226	+ 0.226	+ 1.041	+ 0.334		+ 0.481	- 0.334	
0=+ 0.092		- 0.395		+ 0.334	+ 1.070	+ 0.341		- 0.334	
0=+ 1.499					+ 0.341	+ 1.341	+ 0.663	+ 0.663	- 0.663
0=+ 1.272				+ 0.481		+ 0.663	+ 1.388	+ 0.663	- 0.663
0=+ 0.769				- 0.334	- 0.334	+ 0.663	+ 0.663	+ 1.780	- 0.663
0=- 2.493						- 0.663	- 0.663	- 0.663	+ 1.081
0=+ 0.623									+ 0.193
0=+ 0.753									- 0.225
0=+ 4.569				+ 0.334	+ 0.334			- 0.334	
0=+ 2.019				- 0.481			- 0.481		
0=+ 3.692					- 0.341	- 0.341			
0=+ 1.077									
0=+ 1.660									
0=+ 0.724									
0=- 0.263									
0=- 0.561									
0=+ 1.254									
0=+ 0.321									
0=- 193.424	- 19.6319	- 7.8096	+ 14.8590	+ 2.5455	+ 6.4298	+ 62.7926	- 120.4266	+ 8.5811	
0=- 481.214	+ 6.9359	- 6.0739	- 6.5800	- 135.5877	+ 60.6413	+ 117.6510	- 122.8940	+ 5.7805	- 5.7805
0=- 83.372	+ 5.8948	+ 5.8948		- 97.8090	+ 62.7926	+ 67.1929	+ 3.7226	- 176.3450	- 3.7226
0=+ 250.815		+ 22.3822		+ 7.8209	+ 42.3685	+ 21.4436	+ 21.4436	+ 21.4460	- 8.3503
0=+ 367.859						- 2.6077	- 2.6077	+ 9.4273	+ 2.6077
0=- 30.286				+ 0.9564	+ 0.9564	- 2.9259	- 1.5167	- 2.9259	+ 2.9259
0=- 5.199				- 0.6316		+ 2.5050	- 1.3413	- 1.3413	+ 1.3413
0=+ 11.148					- 0.2765				+ 1.7941
0=- 180.874						+ 14.3461	+ 14.3461	+ 14.3461	- 14.3461
0=- 19.875								+ 0.4557	
0=- 48.125				- 0.4557	- 0.4557				
0=- 7.776				+ 6.7197			+ 6.7197		
0=- 129.898					+ 5.5107	+ 5.5107			- 4.5161
0=- 197.689									

continued.

Absolute Term repeated.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.	XVIII.
0=+ 0.610									
0=- 0.233									
0=+ 0.978									
0=+ 0.856			+ 0.334	- 0.481					
0=+ 0.092			+ 0.334		- 0.341				
0=+ 1.499					- 0.341				
0=+ 1.272				- 0.481					
0=+ 0.769			- 0.334						
0=- 2.493	+ 0.193	- 0.225							
0=+ 0.623	+ 0.858	+ 0.326				+ 0.326			
0=+ 0.753	+ 0.326	+ 1.077	- 0.526	- 0.526	- 0.526	+ 0.326	- 0.526		
0=+ 4.569		- 0.526	+ 1.169	+ 0.526	+ 0.526		+ 0.526	- 0.309	
0=+ 2.019		- 0.526	+ 0.526	+ 1.242	+ 0.526		+ 0.526		- 0.235
0=+ 3.692		- 0.526	+ 0.526	+ 0.526	+ 1.141		+ 0.526		
0=+ 1.077	+ 0.326	+ 0.326				+ 0.795	+ 0.202	+ 0.202	+ 0.202
0=+ 1.660		- 0.526	+ 0.526	+ 0.526	+ 0.526	+ 0.202	+ 0.983	+ 0.202	+ 0.202
0=+ 0.724			- 0.309			+ 0.202	+ 0.202	+ 0.786	+ 0.202
0=- 0.263				- 0.235		+ 0.202	+ 0.202	+ 0.202	+ 0.803
0=- 0.561					- 0.274	+ 0.202	+ 0.202	+ 0.202	+ 0.202
0=+ 1.254	- 0.339					+ 0.202	+ 0.202	+ 0.202	+ 0.202
0=+ 0.321						- 0.267			
0=- 193.424			- 8.5811	+ 120.4266	- 62.7926				
0=- 481.214				+ 97.8090	- 62.7926				
0=- 83.372			+ 7.8209	- 12.1654	- 13.8800	- 1.2523	- 13.8800		
0=+ 250.815	- 2.5810	+ 3.2497	- 13.8800	- 13.8800	- 13.8800		+ 1.4414	+ 4.4036	
0=+ 367.859	+ 5.0440	- 1.4414	- 2.0058	+ 1.4414	+ 1.4414		+ 2.2984		+ 4.5211
0=- 30.286	+ 5.0440	- 2.2984	+ 2.2984	- 1.5910	+ 2.2984		+ 1.1675		
0=- 5.199	+ 5.0440	- 1.1675	+ 1.1675	+ 1.1675	- 3.5100		- 7.2711	- 7.2711	- 7.2711
0=+ 11.148	- 6.2714	- 6.1699				- 24.4640	+ 12.7085	- 1.4997	- 1.4997
0=- 180.874	+ 6.7598	- 11.6228	+ 11.6228	+ 11.6228	+ 11.6228	- 1.4997	+ 6.1669	- 0.7087	- 0.6434
0=- 19.875		- 4.2248	+ 5.8073	+ 4.2248	+ 4.2248	- 0.6434	+ 3.5043	- 0.1891	+ 8.0213
0=- 48.125		- 1.1079	+ 1.1079	- 5.3263	+ 1.1079	- 0.1891	+ 0.0040	+ 0.0040	+ 0.0040
0=- 7.776		+ 0.0271	- 0.0271	- 0.0271	- 5.5481	+ 0.0040	+ 2.5624		
0=- 129.898						+ 0.4334			
0=- 197.689	- 4.5161								

continued.

Absolute Term repeated.	XIX.	XX.	XXI.	XXII.	XXIII.	XXIV.	XXV.	XXVI.	XXVII.
0=+ 0.610				- 19.6319	+ 6.9359	+ 5.8948			
0=- 0.233				- 7.8096	- 6.0739	+ 5.8948	- 22.3822		
0=+ 0.978				+ 14.8590	- 6.5800				
0=+ 0.856				+ 2.5455	+ 135.5877	- 97.8090	+ 7.8209		+ 0.9564
0=+ 0.092				+ 6.4298	+ 60.6413	+ 62.7926	+ 42.3685		+ 0.9564
0=+ 1.499					+ 62.7926	+ 117.6510	+ 67.1929	+ 21.4436	- 2.6077
0=+ 1.272					- 120.4266	- 122.8940	+ 3.7226	+ 21.4436	- 2.6077
0=+ 0.769					+ 8.5811	+ 5.7805	- 176.3450	+ 21.4436	+ 9.4273
0=- 2.493						- 5.7805	- 3.7226	- 8.3503	+ 2.6077
0=+ 0.623		- 0.339						- 2.5810	+ 5.0440
0=+ 0.753								+ 3.2497	- 1.4414
0=+ 4.569					- 8.5811		+ 7.8209	- 13.8800	- 2.0058
0=+ 2.019					+ 120.4266	+ 97.8090		- 13.8800	+ 1.4414
0=+ 3.692	- 0.274				- 62.7926	- 62.7926	- 12.1654	- 13.8800	+ 1.4414
0=+ 1.077	+ 0.202	+ 0.202	- 0.267					- 1.2523	
0=+ 1.660	+ 0.202	+ 0.202						- 13.8800	+ 1.4414
0=+ 0.724	+ 0.202	+ 0.202							+ 4.4036
0=- 0.263	+ 0.202	+ 0.202							
0=- 0.561	+ 0.718	+ 0.202							
0=+ 1.254	+ 0.202	+ 0.841						+ 5.0440	- 5.0440
0=+ 0.321			+ 0.974						
0=- 193.424				+ 2045.4726	+ 269.5554	- 116.2745	- 279.3301		
0=- 481.214				+ 269.5554	+ 54494.6995	+ 45888.3414	+ 2297.1447		- 3.8274
0=- 83.372				- 116.2745	+ 45888.3414	+ 58524.4132	+ 18310.4113	+ 442.5315	- 53.8161
0=+ 250.815				- 279.3300	+ 2297.1447	+ 18310.4113	+ 71646.6078	+ 460.1152	- 3751.8525
0=+ 367.859		+ 5.0440				+ 442.5315	+ 460.1152	+ 4595.1659	- 857.4003
0=- 30.286		- 5.0440				- 3.8274	- 53.8161	- 3751.8525	- 857.4003
0=- 5.199		- 5.0440				- 6.1874	+ 1209.8873	+ 1670.1443	- 947.0766
0=+ 11.148	+ 4.9540	- 5.0440							- 764.3677
0=- 180.874	- 7.2711	+ 2.8368	+ 11.0230						- 92.4287
0=- 19.875	- 1.4997	- 9.5038							- 794.7166
0=- 48.125	- 0.6434	- 0.6434				+ 60.3733	+ 197.9904	+ 177.4670	+ 263.9601
0=- 7.776	- 0.1891	- 0.1891				- 2013.0516	- 1634.9756	- 63.2087	+ 6.4774
0=- 129.898	+ 2.5058	+ 0.0040				+ 1218.8335	+ 1218.8335	+ 247.5446	
0=- 197.689		+ 8.4817	+ 2.0009					- 241.5370	

continued.

Absolute Term repeated.	XXVIII.	XXIX.	XXX.	XXXI.	XXXII.	XXXIII.	XXXIV.	XXXV.
0=+ 0.610								
0=- 0.233								
0=+ 0.978								
0=+ 0.856	- 0.6316					- 0.4557	+ 6.7197	
0=+ 0.092		+ 0.2765				- 0.4557		+ 5.5107
0=+ 1.499	- 2.9259	- 2.5040		+ 14.3461			+ 5.5107	
0=+ 1.272	- 1.5167	- 1.3413		+ 14.3461				
0=+ 0.769	- 2.9259	- 1.3413		+ 14.3461	+ 0.4557		+ 6.7197	
0=- 2.493	+ 2.9259	+ 1.3413	+ 1.7941	- 14.3461				
0=+ 0.623	+ 5.0440	+ 5.0440	- 6.2714	+ 6.7598				- 4.5161
0=+ 0.753	- 2.2984	- 1.1675	- 6.1699	+ 11.6228	- 4.2248	- 1.1079	+ 0.0271	- 4.5161
0=+ 4.569	+ 2.2984	+ 1.1675		+ 11.6228	+ 5.8073	+ 1.1079	- 0.0271	
0=+ 2.019	- 1.5910	+ 1.1675		+ 11.6228	+ 4.2248	- 5.3263	- 0.0271	
0=+ 3.692	+ 2.2984	- 3.5100		+ 11.6228	+ 4.2248	+ 1.1079	- 5.5481	
0=+ 1.077			- 24.4640	- 1.4997	- 0.6434	- 0.1891	+ 0.0040	+ 0.4334
0=+ 1.660	+ 2.2984	+ 1.1675	- 7.2711	+ 12.7085	+ 6.1669	+ 3.5043	+ 2.5624	
0=+ 0.724			- 7.2711	- 1.4997	- 0.7087	- 0.1891	+ 0.0040	
0=- 0.263	+ 4.5211		- 7.2711	- 1.4997	- 0.6434	+ 8.0213	+ 0.0040	
0=- 0.561		+ 4.9540	- 7.2711	- 1.4997	- 0.6434	- 0.1891	+ 2.5058	
0=+ 1.254	- 5.0441	- 5.0440	+ 2.8368	- 9.5038	- 0.6434	- 0.1891	+ 0.0040	+ 8.4817
0=+ 0.321			+ 11.0230					+ 2.0009
0=- 193.424								
0=- 481.214		- 6.1874						
0=- 83.372	- 697.3517	+ 1209.8873		+ 197.9904	+ 60.3733	- 2013.0516	+ 1218.8335	
0=+ 250.815	- 62.7812	+ 1670.1443		+ 177.4670	- 1634.9756	- 1634.9756	+ 1218.8335	
0=+ 367.859	- 947.0766	- 764.3677	- 92.4287	+ 794.7166	- 63.2087		+ 247.5446	
0=- 30.286	+ 631.7668	+ 611.2372	- 164.8603	- 263.9601	+ 6.4774			- 241.5370
0=- 5.199	+ 873.0517	+ 618.4013	- 164.8603	- 272.9252		- 2.8440		
0=+ 11.148	+ 618.4012	+ 916.3795	- 164.8603	- 228.2745			- 1.7516	
0=- 180.874	- 164.8603	- 164.8603	+ 2169.0565	+ 183.5146	+ 36.3692	+ 10.6868	- 0.2255	+ 1047.5384
0=- 19.875	- 272.9252	- 228.2745	+ 183.5146	+ 1320.6974	+ 311.5058	+ 201.4201	+ 160.7418	+ 199.4724
0=- 48.125			+ 36.3692	+ 301.5058	+ 383.6513	+ 176.4028	+ 161.3455	
0=- 7.776	- 2.8440		+ 10.6868	+ 201.4201	+ 176.4028	+ 671.4348	+ 161.6051	
0=- 129.898		- 1.7516	- 0.2255	+ 160.7418	+ 161.3455	+ 161.6051	+ 429.7570	
0=- 197.689			- 1047.5384	+ 199.4724				+ 11106.6929

By the solution of the preceding system of equations, the following results are obtained,

Log. I = 9.6108901 +	Log. X = 0.3471203 -	Log. XIX = 0.1176203 -	Log. XXVIII = 9.1671405 -
II = 9.4571625 +	XI = 0.8260472 -	XX = 9.5739356 +	XXIX = 8.4773345 -
III = 0.8147407 -	XII = 1.0743152 -	XXI = 9.7492775 +	XXX = 8.8098607 +
IV = 0.8909431 +	XIII = 0.4925834 +	XXII = 9.1555145 +	XXXI = 9.3587024 +
V = 0.4061556 -	XIV = 0.6926143 -	XXIII = 8.2316216 +	XXXII = 9.1872472 +
VI = 0.0544530 -	XV = 0.7737603 +	XXIV = 8.2469346 -	XXXIII = 9.4355136 -
VII = 0.0486604 +	XVI = 0.6607148 -	XXV = 7.8602968 +	XXXIV = 9.4430566 +
VIII = 9.5537091 -	XVII = 0.8457080 -	XXVI = 9.2560788 -	XXXV = 7.5181910 +
IX = 0.4451720 +	XVIII = 0.8794967 +	XXVII = 8.9254641 +	

And from these by the equations pages 50, 51 we get the corrections :

(1) = + 0.0995	(21) = + 0.4091	(42) = + 0.9694
(2) = + 0.4547	(22) = - 1.7804	(43) = + 0.1994
(3) = - 0.6912	(23) = + 0.9492	(44) = - 0.1567
(4) = + 0.5723	(24) = + 0.1796	(45) = + 0.3436
(5) = - 1.1097	(25) = - 0.5626	(46) = - 0.6520
(6) = + 0.1146	(26) = + 2.4265	(47) = + 0.9173
(7) = - 0.5634	(27) = + 0.8258	(48) = + 0.7140
(8) = + 1.3236	(28) = - 0.8208	(49) = - 1.0230
(9) = - 0.2506	(29) = - 0.3471	(50) = + 0.1156
(10) = - 0.1800	(30) = + 0.2675	(51) = - 0.8571
(11) = + 1.2361	(31) = - 0.4708	(52) = + 0.1462
(12) = + 1.0214	(32) = + 1.1574	(53) = + 0.8663
(13) = - 0.5884	(33) = + 1.1791	(54) = + 0.8351
(14) = - 0.6779	(34) = - 1.7159	(55) = - 0.8825
(15) = + 0.4197	(35) = + 0.6684	(56) = + 0.1914
(16) = - 1.4778	(36) = - 0.1476	(57) = - 0.5748
(17) = + 0.0875	(37) = - 0.9395	(58) = - 0.0740
(18) = + 0.2955	(38) = - 0.0835	(59) = - 0.0487
(19) = - 0.6456	(39) = - 1.7971	(60) = - 0.1039
(20) = - 0.5087	(40) = + 0.0830	(61) = + 0.1667
	(41) = - 0.0998	

We now give the calculation of the triangles :

Stations.	Spherical Angles.	Seconds of Reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
1.	° "	"			
Lundy Island	25 40 10.725	8.566	9.63666059	5.10797727	128226.35
Precelly	48 51 22.306	20.146	9.87682595	5.34814263	222916.71
St. Ann's Hill	105 28 33.448	31.288	9.98396227	5.45527895	285285.01
	180 0 6.479				

Stations:	Spherical Angles.	Seconds of Reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
2.	° ' "	"			
Precelly	21 24 26.258	25.952	9.56228563	4.77012847	58901.79
St. Ann's Hill	31 12 28.540	28.233	9.71445054	4.92229338	83616.77
Newton Down.....	127 23 6.122	5.815	9.90013443	5.10797727	128226.35
	180 ° 0.920				
3.					
Lundy Island	15 19 16.355	15.364	9.42197465	4.77012847	58901.79
St. Ann's Hill	74 16 4.909	3.918	9.98341847	5.33157229	214571.63
Newton Down* ...	90 24 41.709	40.718	9.99998881	5.34814263	222916.71
	180 ° 2.973				
4.					
Lundy Island	10 20 54.371	53.509	9.25437836	4.92229338	83616.77
Precelly	27 26 56.047	55.185	9.66362727	5.33157229	214571.63
Newton Down* ...	142 12 12.168	11.306	9.78736393	5.45527895	285285.01
	180 ° 2.586				
5.					
Precelly	20 25 49.094	48.859	9.54290837	4.84298558	69660.34
St. Ann's Hill	19 33 4.669	4.435	9.52459031	4.82466752	66783.25
Plumstone Down...	140 1 6.940	6.706	9.80790006	5.10797727	128226.35
	180 ° 0.703				
6.					
Precelly	41 50 15.352	15.060	9.82413915	4.74783245	55954.169
Plumstone Down...	85 24 7.710	7.418	9.99860008	4.92229388	83616.769
Newton Down.....	52 45 37.814	37.522	9.90097422	4.82466752	66783.246
	180 ° 0.876				
7.					
St. Ann's Hill	50 45 33.209	32.960	9.88901791	4.74783245	55954.169
Plumstone Down...	54 36 59.230	58.981	9.91131393	4.77012847	58901.787
Newton Down.....	74 37 28.308	28.059	9.98417104	4.84298558	69660.338
	180 ° 0.747				
8.					
St. Ann's Hill	29 16 15.776	15.664	9.68925669	4.58970204	38877.832
Plumstone Down...	31 54 4.389	4.277	9.72300878	4.62345413	42019.815
Bolton Hill	118 49 40.172	40.059	9.94254023	4.84298558	69660.338
	180 ° 0.337				
9.					
St. Ann's Hill	21 29 17.433	17.362	9.56384746	4.39934776	25081.168
Newton Down.....	37 51 26.299	26.228	9.78795383	4.62345413	42019.815
Bolton Hill	120 39 16.481	16.481	9.93462817	4.77012847	58901.787
	180 ° 0.213				
10.					
Newton Down.....	36 46 2.009	1.943	9.77711146	4.58970204	38877.832
Plumstone Down...	22 42 54.840	54.775	9.58675718	4.39934776	25081.168
Bolton Hill	120 31 3.348	3.282	9.93524187	4.74783245	55945.169
	180 ° 0.197				

* The angles at Newton Down in triangles 3 and 4 are supplementary.

Stations.	Spherical Angles.	Seconds of Reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
11.	° ' "	"			
Precelly	25 6 7.910	7.717	9.62760476	4.58970204	38877.832
Plumstone Down...	108 7 2.551	2.357	9.97791638	4.94001366	87099.098
Bolton Hill	46 46 50.119	49.926	9.86257024	4.82466752	66783.246
12.	180 ° 0.580				
Precelly ..	16 44 7.442	7.278	9.45931935	4.39934776	25081.168
Newton Down.....	89 31 39.823	39.658	9.99998525	4.94001366	87099.098
Bolton Hill	73 44 13.228	13.064	9.98226497	4.92229338	83616.769
13.	180 ° 0.493				
Bolton Hill	51 31 5.536	5.509	9.89365405	4.29536788	19740.942
Newton Down.....	44 27 25.856	25.829	9.84533123	4.24704506	17662.211
Cunnagar.....	84 1 28.689	28.662	9.99763393	4.39934776	25081.168
14.	180 ° 0.081				
Bolton Hill	68 59 57.811	57.761	9.97014993	4.56213237	36486.514
Plumstone Down...	26 52 1.274	1.224	9.65506262	4.24704506	17662.211
Cunnagar.....	84 8 1.066	1.015	9.99771960	4.58970204	38877.832
15.	180 ° 0.151				
Precelly	11 20 32.893	32.802	9.29374371	4.29536788	19740.942
Newton Down.....	45 4 13.966	13.875	9.85001888	4.85164305	71062.920
Cunnagar.....	123 35 13.416	13.323	9.92066921	4.92229338	83616.769
16.	180 ° 0.275				
Precelly	30 29 42.459	42.270	9.70540549	4.56213237	36486.514
Plumstone Down...	81 15 1.276	1.088	9.99491618	4.85164305	71062.920
Cunnagar.....	68 15 16.831	16.642	9.96794065	4.82466752	66783.246
17.	180 ° 0.566				
Bolton Hill	68 57 51.574	51.538	9.97004781	4.41050333	25733.765
Newton Down.....	45 34 24.561	24.525	9.85378868	4.29424420	19689.931
Croft.....	65 27 43.973	43.937	9.95889224	4.39934776	25081.168
18.	180 ° 0.108				
Bolton Hill	51 33 11.773	11.726	9.89386517	4.48822570	30776.959
Plumstone Down...	30 4 10.934	10.887	9.69988367	4.29424420	19689.931
Croft.....	98 22 37.434	37.387	9.99534151	4.58970204	38877.832
19.	180 ° 0.141				
Precelly	15 20 40.603	40.486	9.42262833	4.41050333	25733.765
Newton Down.....	43 57 15.262	15.145	9.84141155	4.82928655	67497.323
Croft	120 42 4.486	4.369	9.93441838	4.92229338	83616.769
	180 ° 0.351				

Stations.	Spherical Angles.	Seconds of Reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
20.	o ' "	"			
Precelly	26 29 34'749	34'591	9'64942012	4'48822570	30776'959
Plumstone Down...	78 2 51'617	51'460	9'99048097	4'82928655	67497'323
Croft.....	75 27 34'107	33'949	9'98586194	4'82466752	66783'246
21.	180 o o'473				
Bolton Hill	73 50 40'842	40'809	9'98250230	4'42202095	26425'362
Newton Down.....	40 25 14'453	14'419	9'81183940	4'25135805	17838'488
St. Thomas' Ch. ...	65 44 4'806	4'772	9'95982911	4'39934776	25081'168
22.	180 o o'101				
Bolton Hill	46 40 22'505	22'466	9'86180218	4'47173746	29630'396
Plumstone Down...	25 58 22'994	22'955	9'64142277	4'25135805	17838'488
St. Thomas' Ch. ...	107 21 14'619	14'579	9'97976676	4'58970204	38877'832
23.	180 o o'118				
Precelly	16 45 47'275	47'144	9'46001803	4'42202095	26425'362
Newton Down.....	49 6 25'370	25'239	9'87848364	4'84048656	69260'649
St. Thomas' Ch. ...	114 7 47'748	47'617	9'96029046	4'92229338	83616'769
24.	180 o o'393				
Precelly	25 4 28'078	27'924	9'62715597	4'47173746	29630'396
Plumstone Down...	82 8 39'556	39'403	9'99590507	4'84048656	69260'649
St. Thomas' Ch. ...	72 46 52'827	52'673	9'98008603	4'82466752	66783'246
25.	180 o o'461				
Bolton Hill	17 26 46'038	46'030	9'47684437	3'77879426	6008'890
Cunnagar.....	100 45 40'814	40'806	9'99229431	4'29424420	19689'931
Croft	61 47 33'172	33'164	9'94509517	4'24704506	17662'211
26.	180 o o'024				
Precelly	4 o 7'710	7'684	8'84381582	3'77879426	6008'890
Cunnagar.....	51 37 37'083	37'056	9'89430811	4'82928655	67497'323
Croft	124 22 15'286	15'260	9'91666461	4'85164305	71062'920
27.	180 o o'079				
Bolton Hill	22 19 35'306	35'297	9'57965052	3'83729063	6875'284
Cunnagar.....	80 16 41'346	41'337	9'99371794	4'25135805	17838'488
St. Thomas' Ch. ...	77 23 43'376	43'366	9'98940495	4'24704506	17662'211
28.	180 o o'028				
Precelly	5 25 14'381	14'345	8'97528077	3'83729063	6875'284
Cunnagar.....	72 6 36'551	36'514	9'97847670	4'84048656	69260'649
St. Thomas' Ch. ...	102 28 9'178	9'141	9'98963319	4'85164305	71062'920
	180 o o'110				

Stations.	Spherical Angles.	Seconds of Reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
29.	° ' "	"			
Cunnagar.....	20 28 59.468	59.467	9.54398425	3.38815627	2444.310
St. Thomas' Ch. ...	59 20 38.840	38.839	9.93462224	3.77879426	6008.890
Croft.....	100 10 21.695	21.694	9.99311861	3.83729063	6875.284
30.	180 0 0.003				
Cunnagar.....	14 47 43.828	43.827	9.40716979	3.18635071	1535.857
Croft	72 47 13.590	13.590	9.98009968	3.75928060	5477.875
Transit Pier.....	92 25 2.584	2.583	9.99961334	3.77879426	6008.890
31.	180 0 0.002				
Croft	27 23 8.104	8.104	9.66273555	3.11093195	1291.017
St. Thomas' Ch. ...	33 10 33.031	33.031	9.73815431	3.18635071	1535.837
Transit Pier.....	119 26 18.865	18.865	9.93995987	3.38815627	2444.310
32.	180 0 0.000				
Cunnagar.....	5 41 15.641	15.640	8.99609885	3.11093195	1291.017
St. Thomas' Ch. ...	26 10 5.809	5.809	9.64444750	3.75928060	5477.875
Transit Pier.....	148 8 38.551	38.551	9.72245753	3.83729063	6875.284
33.	180 0 0.001				
Precelly	4 22 42.827	42.797	8.88278536	3.75928060	5477.875
Cunnagar.....	66 25 20.910	20.881	9.96214178	4.83863702	68966.314
Transit Pier.....	109 11 56.351	56.322	9.97514781	4.85164305	71062.920
34.	180 0 0.088				
Precelly	43 10 11.767	10.712	9.83515816	5.37962469	239676.08
Lundy Island	11 21 14.537	13.481	9.29417049	4.83863702	68966.31
Transit Pier.....	125 28 36.862	35.807	9.91081242	5.45527895	285285.01
	180 0 3.166				

2.

We now know exactly the position of the Transit Pier in the Principal Triangulation, it is in fact stated in the last triangle of the preceding table; and we next proceed to determine its position relative to the line drawn from Greenwich towards Feaghmain making an azimuthal angle at Greenwich with the north meridian line of $81^{\circ} 59' 13'' \cdot 880$. For the calculation of the position of this line in the Triangulation we refer to the "*Extension of the Triangulation, &c.*," pages 40-42. The point D in this line, it will be seen is 54295.197 [log. = 4.73476141] feet distant in a southerly direction from Precelly. The angle Lundy, Precelly, D we obtain as follows:—from page 41 we have

Cradle, Precelly, C $14^{\circ} 19' 4'' \cdot 059$

C, Precelly, D $85 \quad 27 \quad 45 \cdot 605$

Cradle, Precelly, D $99 \quad 46 \quad 49 \cdot 664$

Again, referring to the "*Account of the Principal Triangulation*," pages 144 and 383, or page 460, we find the angle

Cradle, Precelly, Lundy... $86^{\circ} 16' 35'' \cdot 769$

whence we obtain the angle

Lundy, Precelly, D $13^{\circ} 30' 13'' \cdot 895$

Subtracting this from the angle at Precelly between the Transit Pier and Lundy we have

Transit Pier, Precelly, D..... $29^{\circ} 39' 57'' \cdot 872$

Now let P be the point in which a perpendicular from the Transit Pier meets the line from Greenwich to Feaghmain, then we proceed as follows :

Distances and Triangles connecting the Priory Transit Pier, Haverfordwest, with Greenwich Observatory.

Points.	Spherical Angles.	Seconds of reduced Angles.	Log. Sines.	Log. Distances.	Distances in Feet.
1.	° ' "	"			
Precelly	29 39 57.871	57.726	9.69455576	3.53902389	34595.841
Transit Pier	50 57 57.456	57.311	9.89029328	4.73476141	54295.197
D.	99 22 5.109	4.963	9.99416889	4.83863702	68966.314
	180 0 0.436				
2.					
Transit Pier	85 10 9.310	9.302	9.99845456	4.53747845	34472.950
D.	4 49 50.714	50.706	8.92537743	3.46440132	2913.408
P.	89 59 60.000	59.992	0.00000000	4.53902389	34595.841
	180 0 0.024				
3.					
Greenwich Obsv...	0 8 50.647	50.388	7.41016789	3.46440132	2913.408
Transit Pier	89 51 10.130	9.871	9.99999856	6.05423199	1133005.44
P.	89 59 60.000	59.741	0.00000000	6.05423343	1133009.18
	180 0 0.777				

The Distance, Greenwich to A = $386140 \cdot 49$ ^{Feet.}
 „ A to B = $232596 \cdot 47$
 „ B to C = $136657 \cdot 46$
 „ C to D = $343138 \cdot 07$
 „ D to P = $34472 \cdot 95$ } *Extension of Triangulation into France and Belgium, pp. 40, 41.*
 „ Greenwich to P = $1133005 \cdot 44$ } *See above Δ 2.*

Finally, in order to get the *direction* of the Transit Pier from Greenwich we have—
 Angle, Transit Pier, Greenwich, P = $0^{\circ} 8' 50'' \cdot 647$ (*See above Δ 3.*)
 „ Arbury Hill, Greenwich, P = $37 22 32 \cdot 019$ (*Extⁿ of Triangⁿ, p. 40.*)
 „ Chingford, Greenwich, Arbury Hill = $44 36 40 \cdot 221$ (*Principal Triangⁿ, p. 498.*)

These angles added together give the angle at Greenwich between Chingford and the Transit Pier. We have then finally for the position of Colonel Forsch's Station, the following—

GREENWICH to TRANSIT PIER	1133009.18 feet
CHINGFORD, GREENWICH, TRANSIT PIER	82° 8' 2".887

3.

At Greenwich the azimuth of Chingford is 1".64 to the west of north. Hence the azimuth of the Priory Transit Pier at Greenwich is

$$82^{\circ} 8' 4''.527$$

We shall now proceed to calculate the longitude of the Transit Pier in precisely the same manner as the longitude of Feaghmain was computed in the "*Extension of the Triangulation*," page 49:

$$\begin{aligned} a &= 20926348 \\ b &= 20855233 \\ \log (n \sin 1'') &= 2.00717204 \\ \log (N \sin 1'') &= 2.00718515 \\ \log e^2 &= 7.8315592 \\ \log \frac{e^2}{1 - e^2} &= 7.8345158 \end{aligned}$$

where n is the normal for the latitude of Greenwich $51^{\circ} 28' 39''.864$, and N the normal for 52°

$$\begin{aligned} \log s &= 6.05423343 \\ \log (n \sin 1'') &= 2.00717204 \end{aligned}$$

$$\log (\text{first term of } \theta) = 4.04706139 \text{ in seconds.}$$

ϵ 7.83452	$\cos^2 \alpha$ 5.6957	$\epsilon \cos \alpha \cos \lambda \sin \lambda$.. 6.6585
$\cos \lambda$ 9.79436	$1 + U_2$ 0.0000	$1 + 2 U_2$ 0.0000
$\cos \alpha$ 9.13623	$\cot 6''$ 4.5363	$\cot 8''$ 4.4113
$\sin \lambda$ 9.89341	$\left(\frac{s}{n}\right)^3$ 6.1979	$\left(\frac{s}{n}\right)^4$ 4.9305
$\frac{s}{n}$ 8.73264	$\log 2d \text{ term}$ 6.4299	$\log 3d \text{ term}$ 6.0003

$$\begin{aligned} \text{First term} & 3^{\circ} 5' 44''.5206 \\ \text{Second } ,, & + .00027 \\ \text{Third } ,, & - .00010 \\ \hline \theta & = 3 \ 5 \ 44 \ .5208 \end{aligned}$$

$$\begin{aligned} \frac{1}{2} (90 - \lambda + \theta) & \dots \log \sec = 0.02929523 \dots \log \operatorname{cosec} = 0.44946166 \\ \frac{1}{2} (90 - \lambda - \theta) & \dots ,, \cos = 9.97890647 \dots ,, \sin = 9.48323610 \\ \frac{1}{2} \alpha & \dots ,, \cot = 0.05980691 \dots ,, \cot = 0.05980691 \\ 49^{\circ} 28' 4''.478 & \dots ,, \tan = 0.06800861 \dots ,, \tan = 9.99250467 \\ 44 \ 30 \ 20 \ .164 & \end{aligned}$$

$$4 \ 57 \ 44 \ .314 = \text{Longitude of Priory Transit Pier} (= 17864''.314)$$

In order to get the length of the corresponding arc of parallel in latitude 52° , we proceed as follows :

$$\begin{array}{ll} \log 17864 \cdot 314 & \dots\dots\dots 4 \cdot 25198634 \\ \log (N \sin 1'') & \dots\dots\dots 2 \cdot 00718515 \\ \log (\cos 52^\circ) & \dots\dots\dots 9 \cdot 78934198 \\ \log L & \dots\dots\dots 6 \cdot 04851347 \end{array}$$

hence the length of the arc of parallel in 52° between the meridian of Greenwich and the Priory Transit Pier is

$$1118184 \cdot 5 \text{ feet}$$

supposing the elements of the earth to be as used in this calculation. If, however, we give to the semiaxes increments δa and δb , then we shall find that the length of the arc of parallel on a spheroid whose semiaxes are

$$\begin{array}{l} a = 20926348 + \delta a \\ b = 20855233 + \delta b \end{array}$$

is, computing in precisely the same manner as described in the "*Extension of the Triangulation*," pages 51, 52, increased by $+0 \cdot 003015 \delta a - 0 \cdot 000264 \delta b$.

The final lengths of the three arcs are then to be taken as follows :

$$\begin{array}{ll} \text{GREENWICH to MOUNT KEMMEL} & \dots\dots\dots 634157 \cdot 4 + 0 \cdot 002692 \delta a - 0 \cdot 000555 \delta b \\ \text{GREENWICH to HAVERFORDWEST} & \dots\dots\dots 1118184 \cdot 5 + 0 \cdot 003015 \delta a - 0 \cdot 000264 \delta b \\ \text{GREENWICH to FEAGHMAIN} & \dots\dots\dots 2330944 \cdot 1 + 0 \cdot 006228 \delta a - 0 \cdot 000561 \delta b \end{array}$$

DESCRIPTION OF STATIONS.

PRECELLY.—This station is on the highest part of the range of hills known as Mynydd Precelly in the northern part of Pembrokeshire. It is about six miles south-east of Newport, and three miles north of Maenclochog. There are no defined objects near the station to which measurements could be made. The centre mark is sunk 3 feet 3 inches below the general surface of the hill.

ST. ANN'S HILL.—This station is on the southern side of a pasture field, the second field east from Burnt Farm House, about $\frac{3}{4}$ mile south of the village of Dale. It is on the property of Mr. Lloyd Philips of Dale, known as Merryborough Farm. The centre mark is 2 feet 4 inches below the general surface of the ground.

PLUMSTONE DOWN.—This station is near the eastern declivity of Dudwell Mountain, $\frac{1}{4}$ mile west of Plumstone Rock and $\frac{1}{4}$ mile east of Cuffern Mountain. There are no defined objects near the station to which measurements could be made. Centre mark 1 foot 3 inches below the surface of the ground.

BOLTON HILL.—This station is in the hedge near the highest part of the hill. It is about 20 chains south-west of Bolton Hill farm house and 4 miles south-west of Haverfordwest. Centre mark 1 foot below surface.

NEWTON DOWN.—This station is in the high ground about 10 chains east of the Butchers' Arms, $\frac{1}{2}$ mile west of Newton farm house, and 10 chains east of the road from Haverfordwest to Burton. Centre mark 1 foot 6 inches below surface of ground.

CUNNAGAR.—This station is in the north-west corner of a field, about 20 chains west of Cunnagar farm house, and $1\frac{1}{2}$ miles south of Saint Thomas's Church, Haverfordwest. Centre mark 1 foot 8 inches below general surface of ground.

CROFT.—This station is in the angle of a fence on the high ground about 20 chains south of Haverfordwest railway station, and 20 chains east of Saint Thomas's Church, Haverfordwest. Centre mark 1 foot 3 inches below surface.

ST. THOMAS'S CHURCH TOWER, HAVERFORDWEST.—The station is on the north side of the roof. The exact position is marked by a broad arrow on the slates of the roof.

PRIORY TRANSIT PIER, NORTH.—This pier was erected in a field near the southern part of the town of Haverfordwest, close to the ruins of the Priory, and near the railway bridge over the Western Cleddan. Centre mark 1 foot 9 inches below surface of ground.

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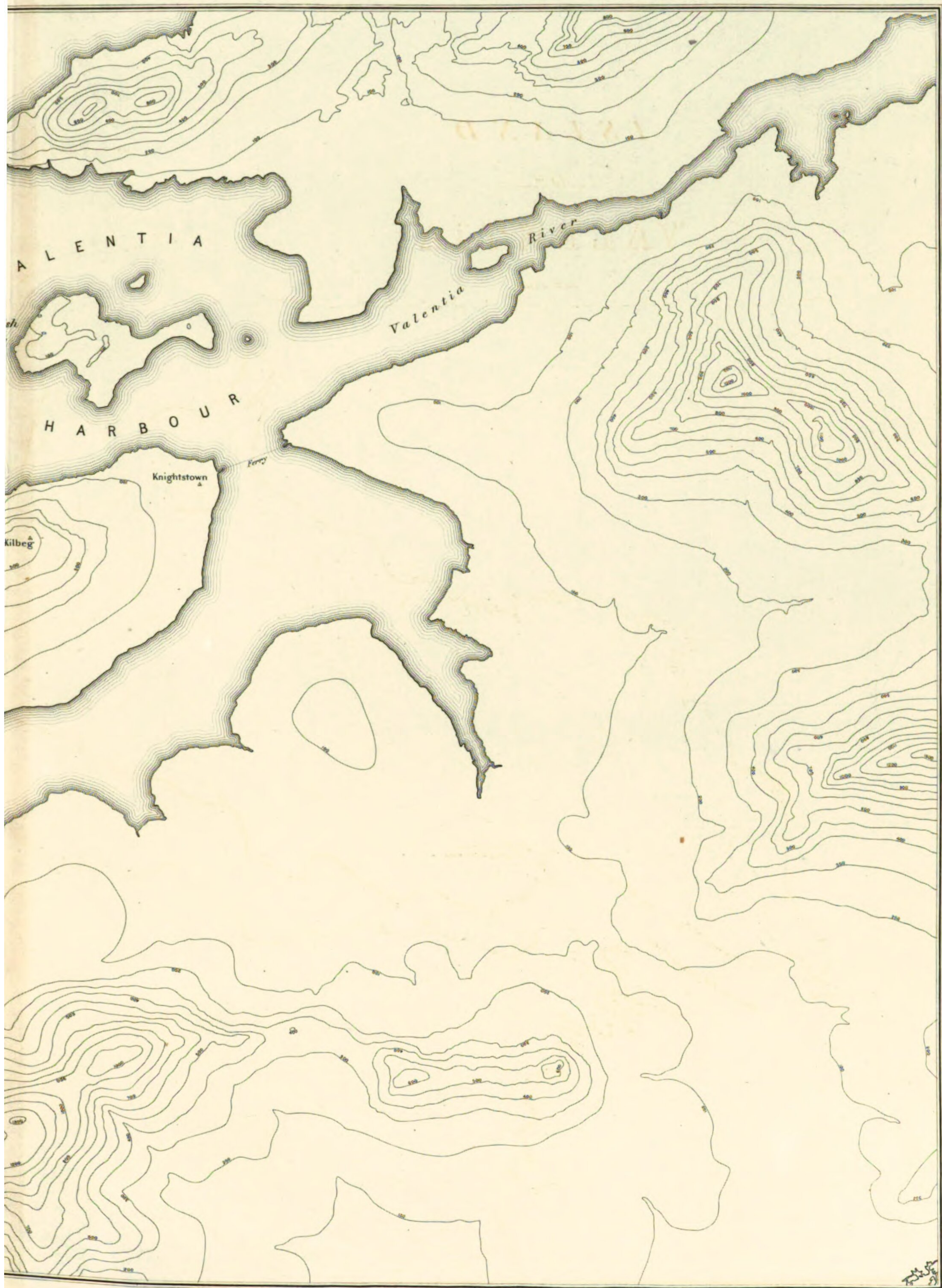
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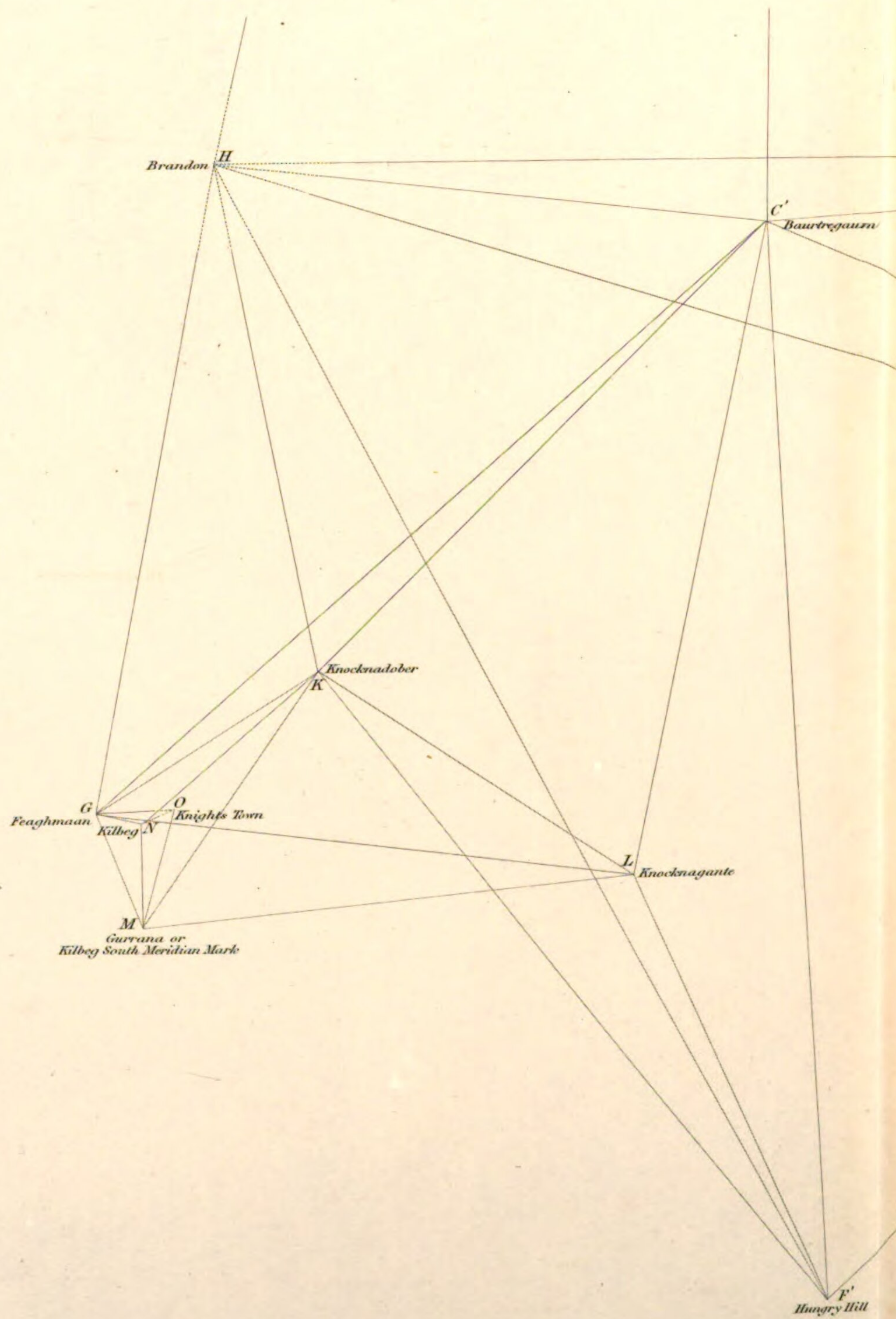
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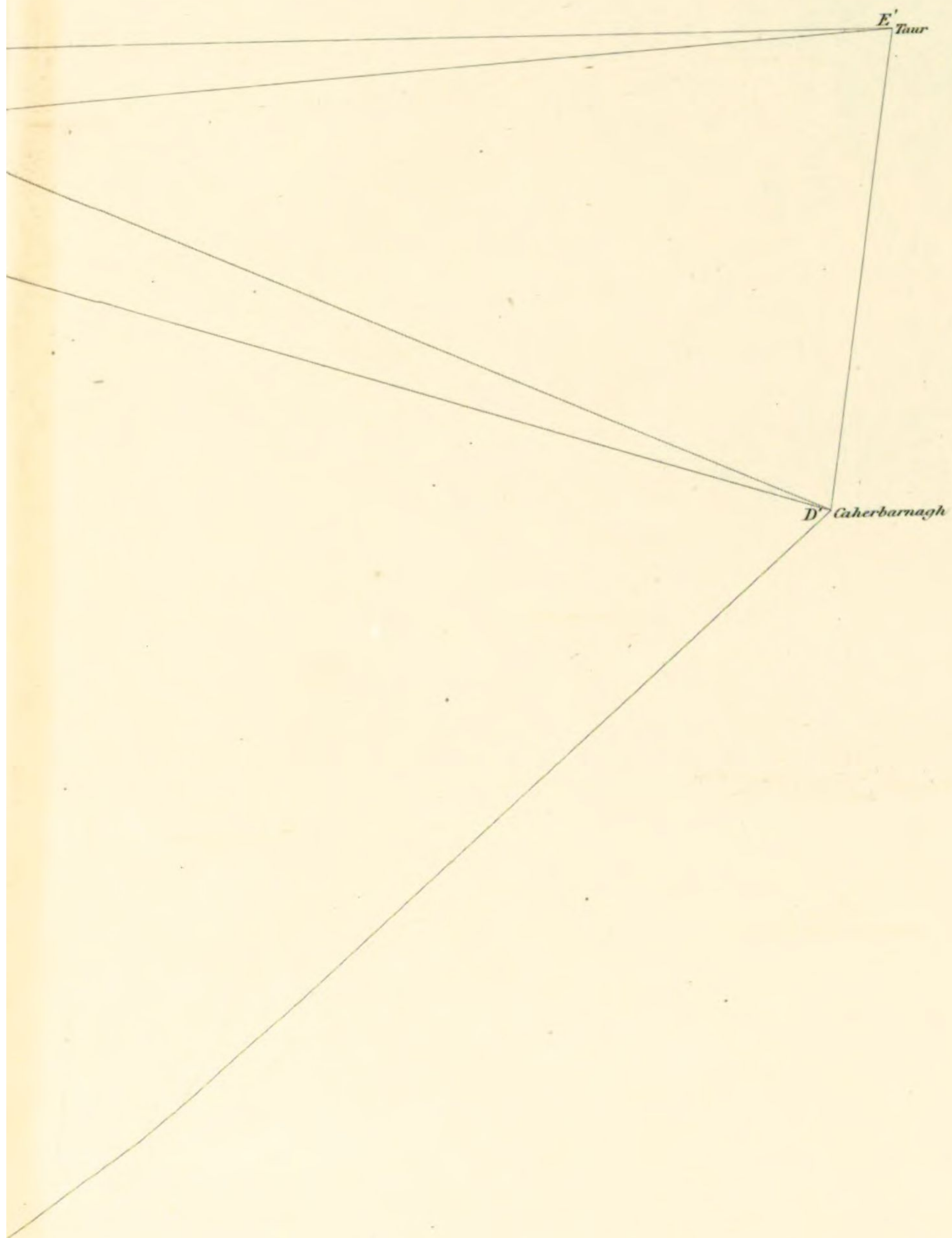
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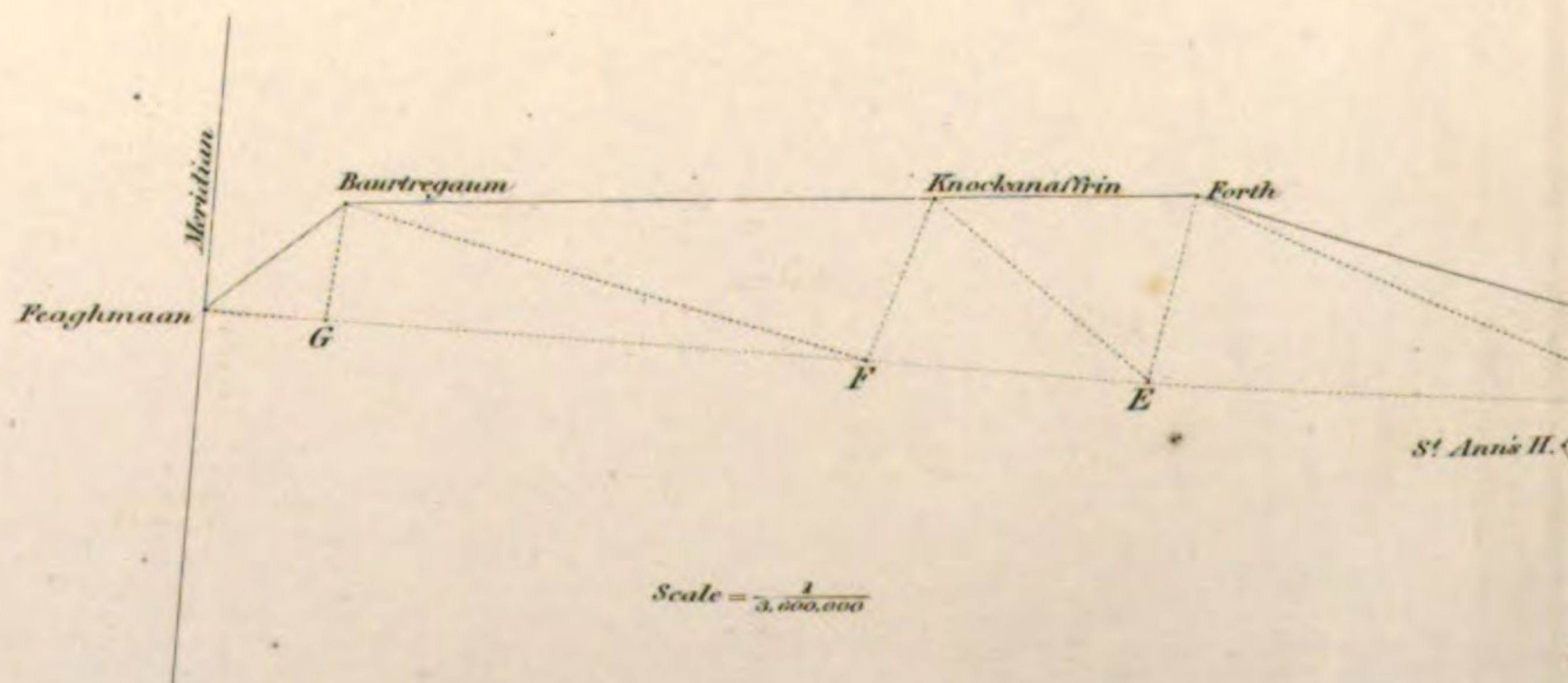
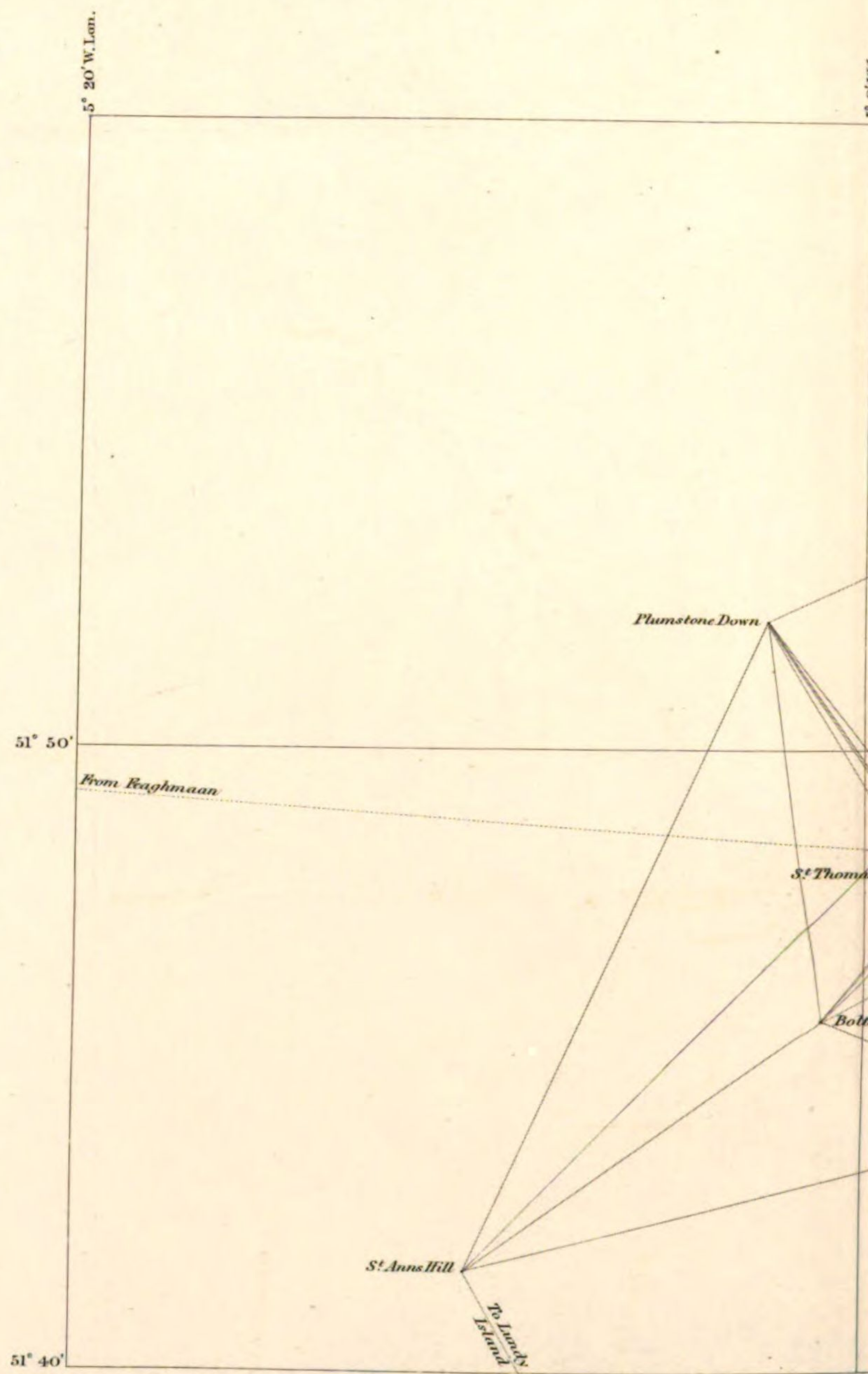
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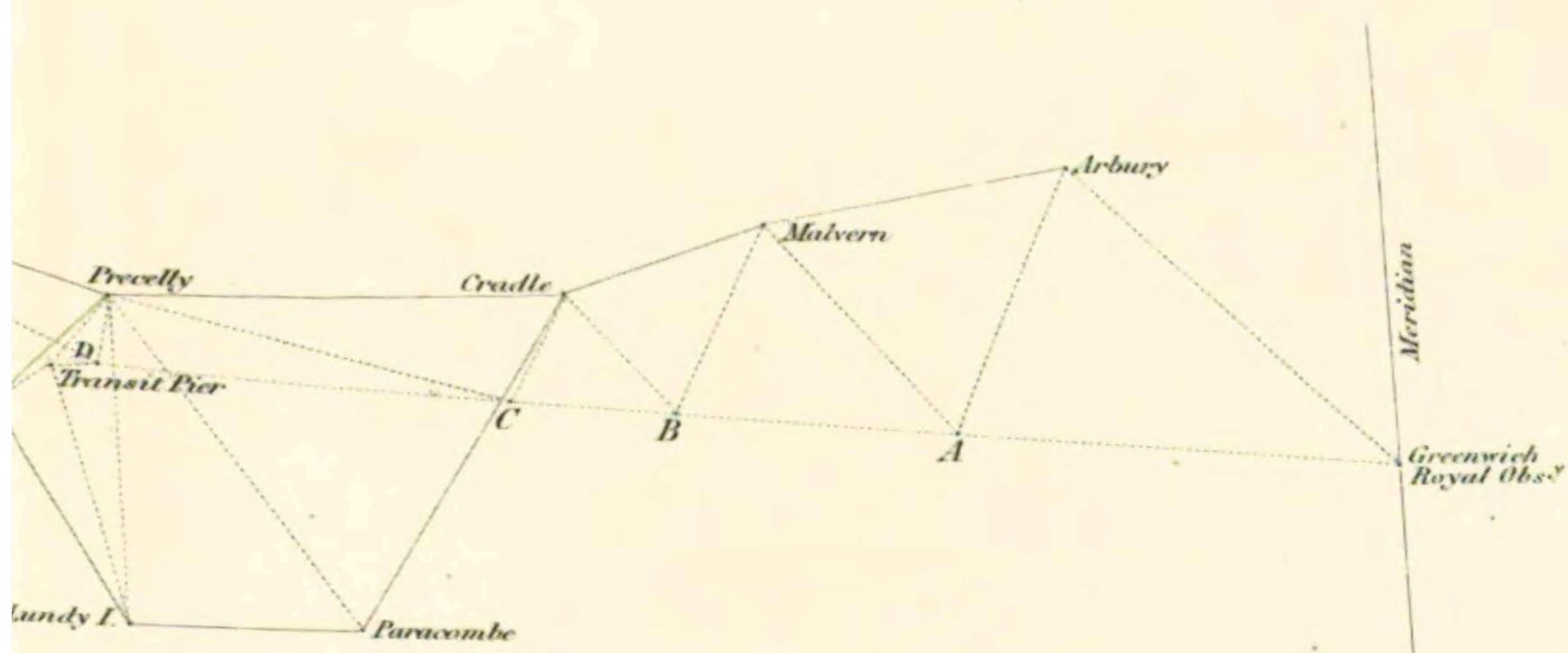
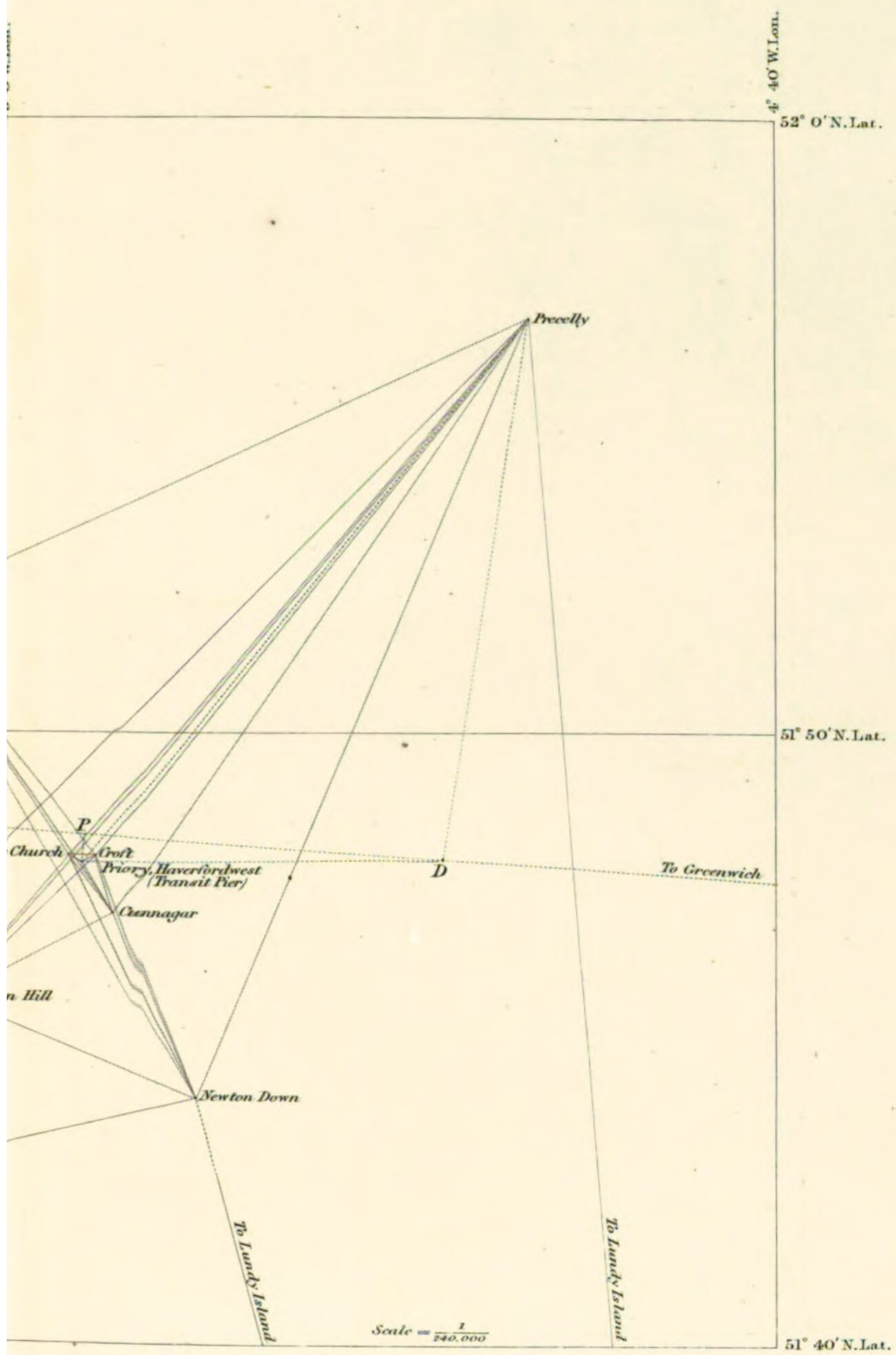


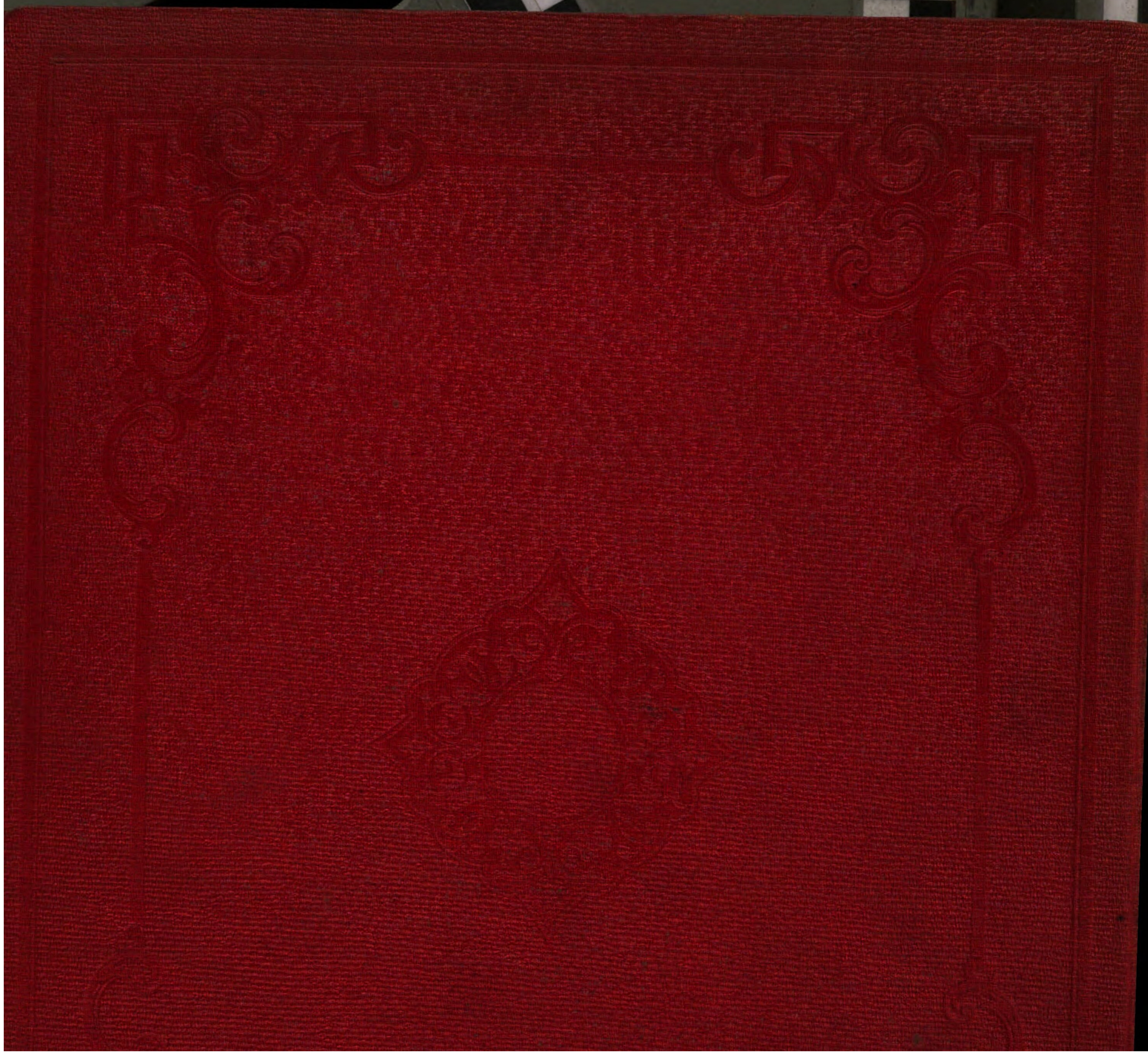












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